PATENT

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Date of Signature
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Carl R. Schwartz, Reg. No. 29,437

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Jeffrey F. Tempas
Serial No.: 10/821,779
Filed: April 9, 2004
For: Non-Damming Coupler
Examiner : James M. Hewitt
Art Unit : 3679

Commissioner For Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Advice To PTO Regarding Additional Art

In the above described case the issue fee has been paid and Applicant understands that there will be a likely patent issued on June 6, 2006. The purpose of the present communication is to advise the PTO on an expedited basis that on May 3, 2006 the EPO issued a supplemental search report in a corresponding case (copy enclosed). This was received by our offices on May 23, 2006 and has just been reviewed.

Two of the noted references have already been considered by the U.S. Office. With respect to the other three:

Applicant agrees with the EP searcher that neither of the two foreign references (copies enclosed) are particularly relevant to the EP subject matter, and further believes that they are not particularly relevant to the allowed U.S. claims. Nevertheless, they are enclosed herewith to make a more complete record for the PTO.

With respect to U.S. patent 4,661,041, it is not relevant to the nub distinction which the U.S. examiner found significant with respect to some claims. While it is of some interest with respect to the o-ring distinction that the examiner found significant for other claims, it is essentially cumulative to U.S. patent 5,071,388 (copy enclosed for comparison) which was already considered by the U.S. examiner.

Hence, Applicant does not believe that this latest art affects the U.S. allowed claims. Thus, Applicant sees no

reason to request withdrawing this application from issuance. However, this communication is being expedited to the PTO so as to provide the examiner with a final opportunity to consider the issue independently (e.g. whether the PTO believes otherwise and wishes to on its own motion withdraw issuance for further consideration).

Finally, Applicant notes that it has no translation of the EP reference and knows nothing about why it was included on the search report except insofar as the search report highlights particular portions and the drawings show. Of course, it was only considered an A reference.

Respectfully submitted,

JEFFREY F. TEMPAS

Dated: May 25, 2006 By: _____

Carl R. Schwartz, Esq.
Reg. No.: 29,437
Quarles & Brady LLP
411 East Wisconsin Avenue
Milwaukee, Wisconsin 53202
(414) 277-5715

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European Patent Office

SUPPLEMENTARY EUROPEAN SEARCH REPORT

Application Number
EP 04 75 9304

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 3 680 896 A (GEORGE MOFFAT CUPIT) 1 August 1972 (1972-08-01) * column 4, line 62 - column 5, line 14 * * figure 8 *	1,2 1-10	INV. F16L21/00 F16L25/14 F16L19/02
Y	US 4 661 041 A (HESSLER ET AL) 28 April 1987 (1987-04-28) * column 1, line 5 - line 23 * * column 3, line 9 - line 36 * * column 4, line 31 - column 5, line 43 * * column 5, line 57 - line 64 * * column 6, line 3 - line 20 * * claims 1,3,6 * * figures 1-3 *	1-10	
A	EP 0 875 706 A (RUSS, JOHANN) 4 November 1998 (1998-11-04) * column 4, line 22 - line 34 * * figure 2 *	1,2	
A	GB 2 011 001 A (FIP FORMATURA INIEZIONE POLIMERI SPA) 4 July 1979 (1979-07-04) * figure *	10	TECHNICAL FIELDS SEARCHED (IPC) F16L
A	US 3 727 953 A (MARTIN R,US ET AL) 17 April 1973 (1973-04-17) * column 5, line 34 - line 54; figures 7,8 *	1,2,5,6	

The supplementary search report has been based on the last set of claims valid and available at the start of the search.

Place of search	Date of completion of the search	Examiner
Berlin	25 April 2006	Jankowska, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C04)

United States Patent [19]

Hessler

[11] **Patent Number: 4,661,041**

[45] **Date of Patent: Apr. 28, 1987**

[54] **SELF-DRAINING PUMP ARRANGEMENT**

[75] Inventor: **William D. Hessler, Wyckoff, N.J.**

[73] Assignee: **ITT Corporation, New York, N.Y.**

[21] Appl. No.: **795,396**

[22] Filed: **Nov. 5, 1985**

[51] **Int. Cl.**[4] **F04D 5/00**

[52] **U.S. Cl.** ..... **415/52; 415/53 R**

[58] **Field of Search** ..... 415/52, 53 R, 53 T, 415/121 R, 121 A, 206

[56] **References Cited**

U.S. PATENT DOCUMENTS

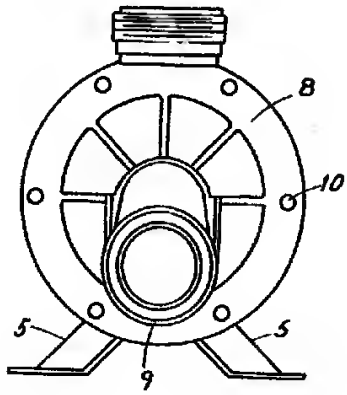
2,734,460	2/1956	Deters et al.	415/11
3,070,025	12/1962	Cliborn	415/53
3,279,386	10/1966	Rupp et al.	415/53
3,322,071	5/1967	Teter	415/53 R
3,348,514	10/1967	Davis	415/206
3,898,014	8/1975	Meister et al.	415/53
4,492,516	1/1985	McCoy, Jr.	415/53

Primary Examiner—Robert F. Garrett
Assistant Examiner—John Kwon
Attorney, Agent, or Firm—John T. O'Halloran; Robert P. Seitter

[57] **ABSTRACT**

A self-draining pump comprises a pump housing which bounds an impeller chamber having a central axis that is substantially horizontal in a position of use of the pump and an open end facing in one axial direction. An output passage of the pump housing communicates with a radially outward region of the impeller chamber. An impeller is received in the impeller chamber for rotation about the central axis for impelling fluid from a radially inward region toward the radially outward region of the impeller chamber. A lid includes a mounting portion mounted on the pump housing for closing the open end of the impeller chamber, an inlet portion axially spaced from the mounting portion and bounding an inlet passage which is centered on an inlet axis that is substantially parallel to the axis and offset therefrom by such a distance that a bottom zone of the inlet passage is at an elevation no higher than a bottom zone of the impeller chamber in the position of use, a connecting portion bounding an internal space connecting the inlet passage with a radial section of the impeller chamber which extends from the radially inward region to the bottom zone of the impeller chamber, and a partitioning wall situated in the internal space for delimiting therein a connecting passage leading from the inlet passage to the radially inward region of the impeller chamber, the partitioning wall including at least one aperture of a limited cross section which communicates the bottom zone of the impeller chamber with the bottom zone of the inlet passage for draining fluid from the bottom zone of the impeller chamber when the inlet passage is connected to a drain.

10 Claims, 4 Drawing Figures



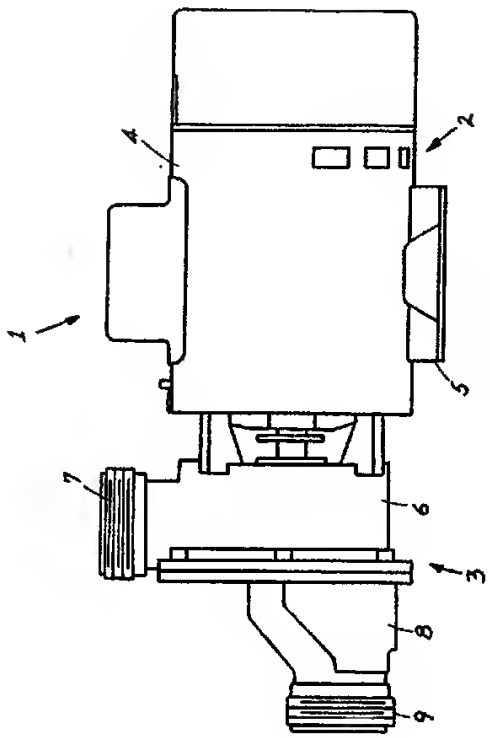


Fig. 1

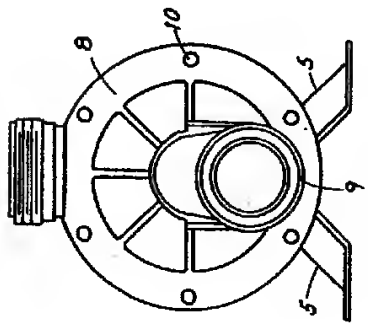


Fig. 2

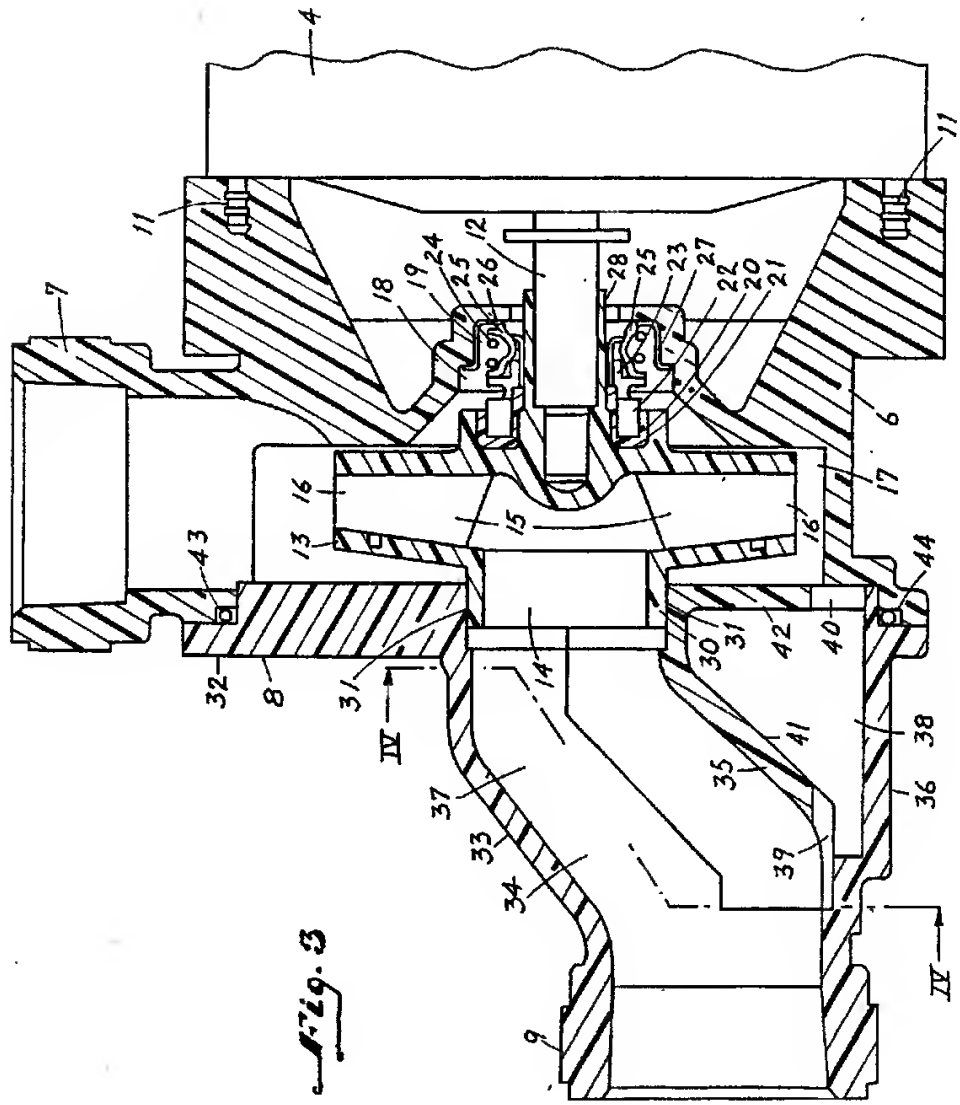

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Fig. 3

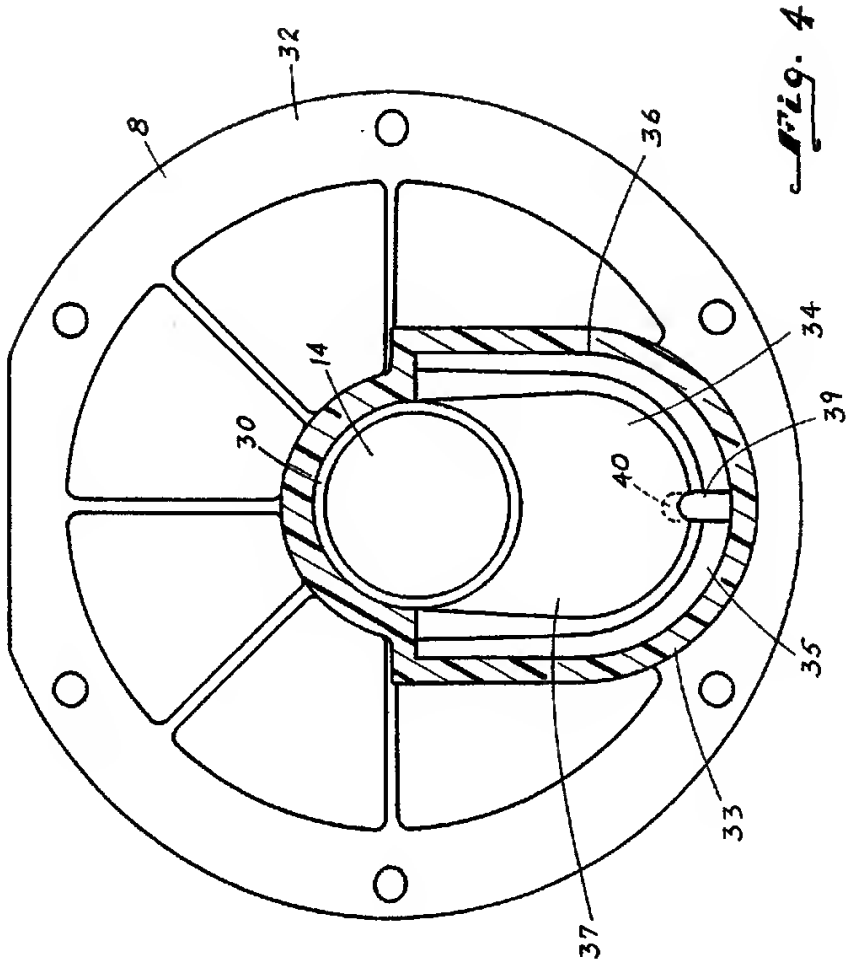

Fig. 4

SELF-DRAINING PUMP ARRANGEMENT

BACKGROUND OF THE INVENTION

The present invention relates generally to pumping arrangements, and more particularly to pumps which are completely self-draining when not being operated.

There are already known various pump constructions, among them such which are often being referred to as self-draining pumps. In pumps of this type, all of the liquid that is being pumped by the pump while in operation is drained out of the pump when the pump is not being operated. The reason for this may be, for instance, when the pump is being used as a recirculating pump in conjunction with a whirlpool bath, a spa, or a similar facility in which water is being recirculated, to assure that no stale water will remain in the pumping system where it could promote growth of bacteria, fungi or mildew with possible attendant unpleasant odor, contamination or even possibly a health hazard. This potential problem has already been previously recognized, and it is for this and similar reasons that the so-called self-draining pumps have been developed.

So, for instance, there has already been proposed a self-draining pump construction in wbich a small aperture is provided in tbe pump housing assembly, this aperture communicating with the lowermost region of the pumping chamber and being connected, during the installation of the self-draining pump, to a drain, so that some of the water from the pumping chamber, which constitutes the high-pressure side of the pump, is drained into the drain even during the normal operation of the pump. Obviously, this is highly wasteful of energy since some of the usually heated water is drained out of the system and may have to be replenished with additional water which usually bas to be heated before being introduced into the system. This energy waste is additional to the wasted energy resulting from the fact that some of the previously pressurized water goes into the drain.

On the other hand, it has also already been proposed to provide an adaptor for a pump with a centrål axial inlet nipple, which adaptor bounds an adaptor passage that leads downwardly from the central passage of the inlet nipple to an elevation low enough to be in substantial horizontal alignment with the bottom region of the pumping chamber of the pump, and to provide a draining passage with a relatively small cross sectional area in the pump housing and/or the adaptor between the bottom region of the pumping chamber and the lowermost region of the adaptor passage. However, experience with pumping arrangements of this type has shown that numerous problems resulting from the provision of the separate adaptor, including but not limited problems with sealing the additional interface between the adapter and the lid of the pump housing on which the adator is mounted, are encountered in this particular pump construction.

SUMMARY OF THE INVENTION

Accordingly, it is a general object of the present invention to avoid the disadvantages of the prior art.

More particularly, it is an object of the present invention to provide a self-draining pumping arrangement which does not possess the drawbacks of the known pump constructions of this type.

Still another object of the present invention is to develop a pump arrangement of the type here under consideration which will render it possible to achieve complete pump draining without running into the difficulties encountered in the known constructions.

It is yet another object of the present invention so to construct the arrangement of the above type as to be able to easily and reliably seal the same.

A concomitant object of the present invention is so to design the pump arrangement of this type as to be relatively simple in construction, inexpensive to manufacture, easy to use, and reliable in operation nevertheless.

In pursuance of these objects and others which will become apparent hereafter, one feature of the present invention resides in a self-draining pump comprising a pump housing bounding an impeller chamber which has a central axis that is substantially horizontal in a position of use of the pump and an open end facing in one axial direction, the pump housing further bounding an output passage which communicates with a radially outward region of the impeller chamber; an impeller received in the impeller chamber for rotation about the central axis for impelling fluid present in the impeller chamber from a radially inward region toward the radially outward region of the latter; and a lid including a mounting portion mounted on the pump housing for closing the open end of the impeller chamber, an inlet portion axially spaced from the mounting portion and bounding an inlet passage which is centered on an inlet axis that is substantially parallel to the axis and offset therefrom by such a distance that a bottom zone of the inlet passage is at an elevation no bigher than a bottom zone of the impeller cbamber in the position of use, a connecting portion bounding an internal space connecting the inlet passage with a radial section of the impeller chamber which extends from the radially inward region to the bottom zone of the impeller chamber, and a partitioning wall situated in the internal space and delimiting therein a connecting passage leading from the inlet passage to the radially inward region of the impeller chamber and separating such connecting passage from the remainder of the internal space and of the section, the partitioning wall including at least one aperture of a limlted cross section which communicates the bottom zone of the impeller chamber with the bottom zone of the inlet passage for draining fluid from the bottom zone of the impeller chamber when the inlet passage is connected to a drain.

A particular advantage of this arrangement is that, since the offset inlet nipple and the connecting portion are constitutent parts of the lid, there is no need to provide any sealing means in addition to those which are needed in any event to seal the interface between the lid and the pump housing. Moreover, the construction and assembly of this pump is relatively simple, particularly when the partitioning wall is constituted by an insert separate from the remainder of the lid and fittingly received in a receiving recess of such lid.

BRIEF DESCRIPTION OF THE DRAWING

Above-mentioned and other features and objects of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a side elevational view of a pumping arrangement embodying the present invention;

Fig. 2 is an end elevational view of the pumping arrangement of FIG. 1;

FIG. 3 is an axial sectional view through a pump of the arrangement of FIGS. 1 and 2, taken on line III—III of FIG. 2; and

Fig. 4 is a cross-sectional view taken on line IV—IV of FIG. 3.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing in detail, and first to FIG. 1 thereof, it may be seen that the reference numeral 1 has been used therein to identify a pumping arrangement embodying the present invention. The pumping arrangement 1 includes, as its main components, a motor 2, especially an electric motor, and a pump 3 which is mounted on the motor 2.

The motor 2 is of any known construction and includes a motor housing 4 which is to be monnted on a support by means of a mounting arrangement 5 which may include, for example 5 as illustrated in FIG. 2 of the drawing 5 mounting legs which may be rigid with or constitute parts of a mounting bracket that is rigidly connected to the motor housing 4 and are provided with respective holes for the passage of connecting screws or bolts connecting such legs to the support therethrough. In the following discussion, it will be assumed, unless otherwise indicated, that the motor housing 4 will be mounted on the support in the illustrated position, that is, on a substantially horizontal surface of the support.

The pump 3 includes a pump housing 6 which is provided with a radially extending outlet nipple 7 and is rigidly connected, in any known manner, to the motor housing 4, and a lid 8 which is provided with an axially extending inlet nipple 9 and is mounted on the pump housing 6 by means of screws or similar fastening elements 10. For the above-mentioned assumed position of use of the motor housing 4 of the pumping arrangement 1, the lid 8 will be mounted on the pump housing 6 in the illustrated orientation. However, either the pump housing 6 may be mounted on the motor housing 4 in any desired one of a plurality of other angularly displaced positions relative to the motor housing 4, or the mounting arrangement 5 for the motor housing 4 may include the aforementioned mounting bracket which is separate from the motor housing 4 so as to be angularly displaceable about the same and connectable to the motor housing 4 in any angularly displaced position relative thereto, so that the lid 8 will always assume the aforementioned orientation in space, regardless of the orientation of the support surface on which the pumping arrangement 1 is mounted.

As shown particularly in FIG. 3, the motor housing 4 and the pump housing 6 are connected with one another by a plurality of studs or other similar connecting elements 11. The motor 2 includes an output shaft which rotates during the operation of the motor 2 about its longitudinal axis and has an end portion 12 which axially projects out of the motor housing 4 and into the interior of the pump housing 6. An impeller 13 is mounted on the output shaft end portion 12 for joint rotation therewith. The impeller 13 is of a known construction and includes an axial inlet 14, a plurality of impeller vanes 15, and a plurality of substantially radially opening outlets 16. During the rotation of the impeller 13 with the output shaft end portion 12, fluid being pumped will enter the impeller 13 through the axial inlet 14 and be impelled by the vanes 15 to move radially outwardly and eventually exit the impeller 13 through the respective outlets 16 to enter a high-pressure space or pumping chamber 17 provided in the pump housing 6 around the impeller 13 and to flow therefrom into the outlet nipple 7 and from there to the desired destination.

The pump housing 6 includes an axial protuberance 18 which surrounds a region of the output shaft end portion 12 and accommodates a sealing arrangement 19. The sealing arrangement 19 includes a sealing boot 20 of an elastomeric material which is received in a recess 21 of the impeller 13, a seating ring 22 of a ceramic material partially received in the recess 21 adjacent to and in sealing contact with the sealing boot 20 and partially projecting out of the recess 21, another sealing ring 23 of a self-lubricating material, such as carbon, which is pressed in contact with the ceramic sealing ring 22 by a helical compression spring 24, and another sealing boot 25, as well as a metallic shell 26 which is fittingly received in a recess 27 of the protuberance 18 and accommodates the spring 24 and the sealing boot 25. The sealing boot 20 and the ceramic sealing ring 22 rotate with the output shaft end portion 12 and with the impeller 13, while the carbon sealing ring 23, the spring 24, the sealing boot 25 and the shell 26 are stationary relative to the pump housing 4 when assembled therewith. The output shaft end portion 12 and a sleeve-shaped mounting portion 28 of the impeller 13 which surrounds a predetermined part of the output shaft end portion 12 pass through the interior of the sealing arrangement 19 with respective radial clearances.

The inlet 14 of the impeller 13 is bounded by a tubular inlet portion 30 of the impeller 13. The tubular inlet portion 30 of the impeller is received, preferably with a minimum clearance, in a cylindrical recess 31 of the lid 8. The lid 8 includes, in addition to the aforementioned inlet nipple, a substantially plate-shaped closing portion 32, and a connecting portion 33 which connects the closing portion 32 with the inlet nipple 9 and is integral with both. The connecting portion 33 bounds an internal space 34 which communicates with the interior of the inlet nipple 9, on the one hand, and with the interior of the pump housing 6, on the other hand.

At its axial end that is closer to the impeller 13, the internal space 34 opens into the recess 31 which is partially bounded by the plate-shaped lid portion 32 and is coaxial with the inlet 14 of the impeller 13, and extends radially outwardly and downwardly therefrom to and beyond the bottom region of the pumping chamber 17. Thus, if the interior of the inlet nipple 9 and thus the internal space is connected with a drain, the fluid present in the interior of the pump housing 6 will flow out into the internal space 34 and from there through the interior of the inlet nipple 9 into the drain not only from the region of the central recess 31, but also from the pumping chamber 17, including the bottom region of the latter. In this manner, it is assured that none of the fluid will remain in the interior of the pump housing 6 where its presence could create a health hazard or create conditions for undesirable contamination by bacteria, fuhgus, mildew or the like. Such complete draining is particularly useful and, in many instances, even required, when the pumping arrangement 1 is to be used for recirculating water, for instance, in a spa or a whirlpool bath, where the likelihood of such undesired growth in the presence of water is quite pronounced.

However, in the absence of any restrictions on the flow of the fluid into and out of the internal space 34, fluid being pumped would be constantly recirculated

through the internal space 34 between the pumping chamber 17 and the inlet 14 of the impeller, so that the pump 3 would work very inefficiently, if at all. Therefore, the lid 8 of the pumping arrangement 1 of the present invention is provided in the internal space 34 thereof with a trough-shaped partitioning wall 35 which, in the illustrated construction, is constituted by an element or insert separate from the connecting portion 33 and the remainder of the lid 8. The insert or partitioning wall 35 completes the radial delimitation of the recess 31. The insert 35 is received, with a minimum if any clearance, in a receiving recess 36 of the lid 8 and partially delimits a feeding passage 37 in the internal space 34, the feeding passage 37 leading from the interior of the inlet nipple 9 to the recess 31 and thus to the inlet 14 of the impeller 13, while separating the remainder of the internal space 34 from the feeding passage 37.

As shown, the insert or partitioning wall 35 does not completely fill the remainder of the internal space 34; rather, it bounds a hollow space 38 which communicates with the passage 37 via a relatively small aperture 39, and with the pumping chamber 17 via another relatively small aperture 40. The apertures 39 and 40 act as flow restrictors or throttles, thus assuring that only an acceptable minimum amount of the pressurized fluid present in the pumping chamber 17 will escape during the pumping operation of the pumping arrangement 1 into the hollow space 38 and from there into the feeding passage 37 to be recirculated back to the inlet 14 of the impeller 13. On the other hand, the apertures 39 and 40 permit the fluid to be drained even from the bottom region of the pumping chamber 17 first into the hollow space 38 and then into the feeding passage 37 and the interior of the inlet nipple 9 when the pumping arrangement 1 is at a standstill and the inlet nipple 9 is connected to a drain. Of course, to achieve such complete draining of the pumping chambers 17, the bottom portion of the interior of the inlet nipole 9 has to be at an elevation not higher than the bottom portion of the pumping chamber 17. To this end, the inlet nipple 9 is radially downwardly offset by the required distance from the recess 31, and the connecting portion 33 and particularly the passage 37 follow an arcuate course.

As illustrated particularly in FIG. 3, the insert includes a substantially trough-shaped or U-shaped portion 41 which extends along an arcuate course between the bottom region of the interior of the inlet nipple 9 and the central or radially inward region of the interior of the pump housing 6, and a closing portion 42 which extends substantially radially ontwardly and downwardly from the portion 42 to close a section of the open end of the interior of the pump housing which is left open by the mounting portion 32 and extends between the radially inward region and the bottom region of the pumping chamber 17. The apertures 39 and 40 are then provided in the portions 41 and 42, respectively.

As already mentioned before, the lid 8 is mounted on the pump housing 6 by means of the fastening elements 10 which have not been shown in FIG. 3 since they are located outside the cross-sectional plane. To seal the lid 8 with respect to the pump housing 6, there is provided a sealing ring 43 which is received in a groove 44 of the pump housing 6 and sealingly contacts both the pump housing 6 and the lid 8 at the region of the groove 43. No separate sealing for the insert 35 is, nor need it be, provided, since any leakage past the insert 35 will have a negligible, if any effect and, in any event, such leakage would be into the feeding passage 37 and not to the exterior of the pump 3, so that it is not objectionable or bothersome.

Further details of the insert 35 and of its accommodation in the internal space 34 may be ascertained from FIG. 4 of the drawing. It may be seen therein that the receiving recess 36 and the insert 35 have substantially U-shaped compatible or complimentary cross-sectional configurations, so that the insert 35 is received in the receiving recess 36 with hardly any leeway. It is also evident from FIG. 4 that the apertures 39 and 40 are located centrally of the insert 34 and thus indeed in axial alignment with the lowermost portion of the interior of the pump housing 6, and that the cross section of the passage 37 has a substantially U-shaped semicircular configuration which gradually changes from a relatively larger diameter which corresponds to that of the interior of the inlet nipple 9 at an upstream end thereof to a relatively smaller diameter at the downstream end thereof which communicates with the inlet 14 bounded by the inlet portion 30 of the impeller 13.

While I have described above the principles of my invention in connection with specific apparatus, it is to be clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention as set forth in the objects thereof and in the accompanying claims.

I claim:

1. A self-draining pump arrangement comprising a motor including a motor housing and an output shaft rotatable about an axis which is substantially horizontal in a position of use of the arrangement and having a free end portion axially projecting out of said motor housing; a pump housing stationarily arranged around said end portion of said output shaft and bounding an impeller chamber which is substantially coaxial with said output shaft and has an open end facing away from said motor housing, and an output passage which communicates with a radially outward region of said impeller chamber; an impeller received in said impeller chamber and connected to said end portion of said output shaft for joint rotation therewith for impelling fluid present in said impeller chamber from a radially inward region toward said radially outward region of the latter; and a lid including a mounting portion mounted on said pump housing for closing said open end of said impeller chamber, an inlet portion axially spaced from said mounting portion and bounding an inlet passage which is centered on an inlet axis that is substantially parallel to said axis and offset therefrom by such a distance that a bottom zone of said inlet passage is at an elevation no higher than a bottom zone of said impeller chamber in said position of use, a connecting portion bounding an internal space connecting said inlet passage with a radial section of said impeller chamber which extends from said radially inward region to said bottom zone of said impeller chamber, and a partitioning wall situated in said internal space and delimiting therein a connecting passage leading from said inlet passage to said radially inward region of said impeller chamber and separating such connecting passage from the remainder of said internal space and of said section, said partitioning wall including at least one aperture of a limited cross section which communicates said bottom zone of said impeller chamber with said bottom zone of said inlet passage for draining fluid from said bottom zone of said impeller chamber when said inlet passage is connected to a drain.

2. The pump arrangement as defined in claim 1, wherein said partitioning wall is constituted by an insert

separate from the remainder of said lid and received in a compatibly configurated receiving recess of said connecting and mounting portions of said lid.

3. The pump arrangement as defined in claim 2, and further including means for sealing said lid relative to said pump housing, said sealing means being arranged between said mounting portion of said lid and said pump housing outwardly of and remotely from said insert.

4. The pump arrangement as defined in claim 1, wherein said partitioning wall delimits a hollow space in said remainder of said internal space, and wherein said aperture includes a first aperture portion which communicates said bottom zone of said impeller chamber with said hollow space, and a second aperture portion which communicates said hollow space with said bottom zone of said inlet passage.

5. The pump arrangement as defined in claim 4, wherein said partitioning wall has a substantially trough-shaped portion partially delimiting said connecting passage, and a closing portion extending substantially radially from said trough-shaped portion to close off said section of said impeller chamber between said radially inward region and said bottom zone, said trough-shaped and closing portions together bounding said hollow space; and wherein said first aperture portion is provided in said closing portion and said second aperture portion is provided in said through-shaped portion.

6. A self-draining pump comprising a pump housing bounding an impeller chamber which has a central axis that is substantially horizontal in a position of use of the pump and an open end facing in one axial direction, said pump housing further bounding an output passage which communicates with a radially outward region of said impeller chamber; an impeller received in said impeller chamber for rotation about said central axis for impelling fluid present in said impeller chamber from a radially inward region toward said radially outward region of the latter; and a lid including a mounting portion mounted on said pump bousing for closing said open end of said impeller chamber, an inlet portion axially spaced from said mounting portion and bounding an inlet passage which is centered on an inlet axis that is substantially parallel to said axis and offset therefrom by such a distance that a bottom zone of said inlet passage is at an elevation no higher than a bottom zone of said impeller chamber in said position of use, a connecting portion bounding an internal space connecting said inlet passage with a radial section of said impeller chamber which extends from said radially inward region to said bottom zone of said impeller chamber, and a partitioning wall situated in said internal space and delimiting therein a connecting passage leading from said inlet passage to said radially inward region of said impeller chamber and separating such connecting passage from the remainder of said internal space and of said section, said partitioning wall including at least one aperture of a limited cross section which communicates said bottom zone of said impeller chamber with said bottom zone of said inlet passage for draining fluid from said bottom zone of said impeller chamber when said inlet passage is connected to a drain.

7. The pump arrangement as defined in claim 6, wherein said partitioning wall is constituted by an insert separate from the remainder of said lid and received in a compatibly configurated receiving recess of said connecting and mounting portions of said lid.

8. The pump arrangement as defined in claim 7, and further including means for sealing said lid relative to said pump housing, said sealing means being arranged between said mounting portion of said lid and said pump housing outwardly of and remotely from said insert.

9. The pump arrangement as defined in claim 6, wherein said partitioning wall delimits a hollow space in said remainder of said internal space, and wherein said aperture includes a first aperture portion which communicates said bottom zone of said impeller chamber with said hollow space, and a second aperture portion which communicates said hollow space with said bottom zone of said inlet passage.

10. The pump arrangement as defined in claim 9, wherein said partitioning wall has a substantially trough-shaped portion partially delimiting said connecting passage, and a closing portion extending substantially radially from said trough-shaped portion to close off said section of said impeller chamber between said radially inward region and said bottom zone, said trough-shaped and closing portions together bounding said hollow space; and wherein said first aperture portion is provided in said closing portion and said second aperture portion is provided in said through-shaped portion.

* * * * *

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 875 706 A1

(12) EUROPÄISCHE PATENTANMELDUNG

(43) Veröffentlichungstag:
04.11.1998 Patentblatt 1998/45

(51) Int. Cl.[6]: **F16L 21/00**, F16L 25/00

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(71) Anmelder: **Russ, Johann**
79801 Hohentengen (DE)

(72) Erfinder: **Russ, Johann**
79801 Hohentengen (DE)

(74) Vertreter:
Patentanwälte
Ruff, Beier, Schöndorf und Mütschele
Willy-Brandt-Strasse 28
70173 Stuttgart (DE)

(54) Anordnung zur Verbindung von Rohren

(57) Zur Verbindung zweier Rohre (1,2) in gegenseitiger Verlängerung schlägt die Erfindung die Verwendung einer Muffe vor, die an beiden Enden doppelwandig ausgebildet ist und eine glatte Innenfläche (10) aufweist. Die Rohrenden (1,2) werden mit ihren Stirnkanten in die Zwischenräume (8,5) zwischen der Außenwand (11) und der Innenwand (10) eingeschoben. Diese Verbindung ermöglicht einen Längenausgleich aufgrund von Temperaturschwankungen und vermeidet störende Ringräume an der Innenseite der Verbindungsstelle.

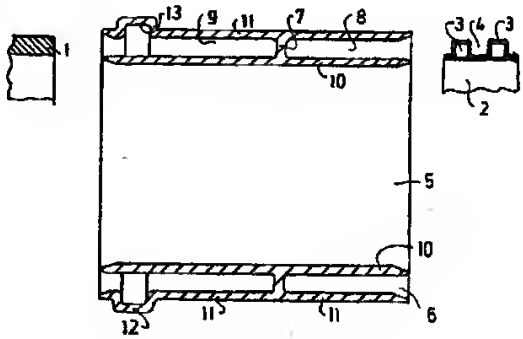

FIG. 1

EP 0 875 706 A1

Beschreibung

Die Erfindung betrifft die Verbindung von Rohren miteinander, insbesondere im Abwasserbereich, bei Druckwasserrohren und bei Kabelschutzrohren. Hierbei liegen die Rohre und damit auch die Verbindungsstellen häufig unter der Erde, d. h. an Stellen, wo die Verbindungsstellen später unzugänglich sind.

Bislang ist es üblich, Rohre, insbesondere aus Kunststoff bestehende Rohre, in diesen Anwendungsfällen dadurch miteinander zu verbinden, daß das eine Rohrende um die Wanddicke des Rohres erweitert, d. h. aufgemufft wird, so daß das Rohr in seinem Endbereich auf ein zweites Rohr aufgeschoben werden kann. Diese übliche Art der Verbindung hat den Vorteil, daß ein Längenausgleich aufgrund von Tempereturunterschieden möglich ist. Die Verbindung hat jedoch den Nachteil, daß an der Innenseite der Rohrverbindung ein Ringreum entsteht, der zu einer Verwirbelung, zum Absetzen von Ablagerungen und dergleichen führt. Selbst bei Kabelschutzrohren entsteht ein Nechteil, wenn nämlich ein Kabel nachträglich durchgeschoben oder durchgezogen werden soll. Des freie Ende des Kabels kann sich dann in diesem Ringraum festsetzen. Hinzu kommt noch, daß in dem Ringraum das Stirnende des einen Rohres eine quer zur Längsachse des Rohres verlaufende Fläche bildet.

Der Erfindung liegt die Aufgabe zugrunde, eine Möglichkeit zur Verbindung zweier Rohre miteinender zu schaffen, bei der einerseits ein Temperatureusgleich möglich bleibt und andererseits die Gefahr des Verschmutzens, beispielsweise durch im Abwesser mitgeführte Feststoffe, der Verwirbelung oder des Hängenbleibens von Kabeln verringert bis beseitigt wird. Zur Lösung dieser Aufgabe schlägt die Erfindung eine Anordnung mit den im Anspruch 1 genannten Merkmalen vor. Weiterbildungen der Erfindung sind Gegenstand von Unteransprüchen, deren Wortlaut durch Bezugnahme zum Inhalt der Beschreibung gemacht wird.

Die Muffe nech der Erfindung wird so verwendet, daß die beiden Stirnseiten der miteinander zu verbindenden Rohre in die Ringräume eingeschoben werden. Dadurch entsteht eine Verbindung, bei der nur die glattflächige Innenseite der Muffe an der Verbindungsstelle vorhanden ist. Die Stirnkanten der beiden Rohre sind innerhalb des Ringreums angeordnet. Ein Temperatureusgleich ist nech wie vor möglich. Die inneren Enden der zylindrischen Stutzen könnten abgeschrägt werden, so daß hier nur ganz kleine Vorsprünge noch vorhanden sind.

Erfindungsgemaß kann in Weiterbildung vorgesehen sein, deß die radiale Abmessung des Ringreums konstant ist und der Dicke des jeweiligen Rohrendes entspricht. Damit liegen dann die Rohrenden an sowohl der inneren Wand als auch der äußeren Wand des Ringreums an.

Erfindungsgemäß kann vorgesehen sein, daß bei einer Muffe, die zwei Rohre gleichen Durchmessers miteinander verbindet, die Innenwände der beiden zylindrischen Stutzen ineinander übergehen. Die Muffe ist en der Innenseite elso wie ein glatter Zylinder ausgebildet.

Insbesondere kann dabei vorgesehen sein, daß die Ringräume nur durch einen radielen Steg voneinander getrennt sind.

In Weiterbildung der Erfindung kann vorgesehen sein, daß bei der geradlinigen Verbindung zweier Rohre mit gleicher Wandstärke auch die Außenwände der beiden zylindrischen Stutzen glatt ineinander übergehen.

Die von der Erfindung vorgeschlagene Muffe kann zum Verbinden zweier Rohre verwendet werden, die an ihrer Außenseite und an ihrer Innenseite glattflächig sind. Dies sind die bisleng üblichen Rohre. Um ein solches Rohr gegenüber der Muffe abzudichten, kann erfindungsgemäß vorgesehen sein, daß eine der beiden Wände, vorzugsweise die Außenwand des Ringraums, eine in den Ringraum hin offene umlaufende Ringnut zur Aufnahme eines Dichtelements aufweist. Die Ringnut kann beispielsweise dadurch gebildet sein, daß die Muffe in diesem Bereich bei gleichbleibender Wandstärke nach außen verformt ist. Des in der Ringnut festgehaltene Dichtelement liegt dabei auf der glattflächigen Außenseite des Rohrendes auf, so daß die Verbindung auch dicht bleibt, wenn sich das Rohrende aufgrund von Temperaturschwankungen verschiebt.

Die Muffe nach der Erfindung kann auch dazu verwendet werden, sogenennte Leichtgewichtsrohre miteinander oder mit glattflächigen Rohren zu verbinden. Leichtgewichtsrohre oder auch Mehrschichtrohre bestehen aus zwei dicht miteinander verbundenen Rohren, von denen das innere Rohr zylindrisch ist, während das äußere Rohr rippenartige Ringvorsprünge und zwischen diesen Ringnuten aufweist. Solche Leichtgewichtsrohre weisen eine bei gleichem Gewicht größere Ringsteifigkeit oder umgekehrt bei gleicher Steifigkeit ein deutlich niedrigeres Gewicht auf als Vollwandrohre.

Um auch ein Leichtgewichtsrohr gegenüber der Muffe abdichten zu können, kann ein Dichtelement in einem Ringraum zwischen zwei Rippen untergebrecht sein, wobei dieser Ringraum eine Art Nut bildet, so daß das Dichtelement gegenüber der glattflächigen Wand der Muffe abdichtet.

Mit Hilfe der von der Erfindung vorgeschlagenen Muffe können Rohre unterschiedlichen Durchmessers, unterschiedlicher Wandstärke geradlinig oder auch unter einem Winkel miteinander verbunden werden.

Erfindungsgemäß kann die Muffe einen dritten oder auch einen nochmals weiteren zylindrischen Stutzen zur Bildung eines Abzweigs zur Verbindung mit einem weiteren Rohr aufweisen. Dieser Stutzen kann geneuso aufgebaut sein wie die beiden anderen Stutzen.

Weitere Merkmale, Einzelheiten und Vorzüge der Erfindung ergeben sich eus der folgenden Beschreibung bevorzugter Ausführungsformen der Erfindung sowie enhand der Zeichnung. Hierbei zeigen:

Fig. 1 einen Längsschnitt durch eine Muffe zur Verbindung eines glattflächigen Rohres mit einem Leichtgewichtsrohr;

Fig. 2 einen Längsschnitt durch eine Muffe zur Verbindung zweier Rohre unterschiedlichen Durchmessers;

Fig. 3 einen Längsschnitt durch eine Muffe mit einer schräg verlaufenden Abzweigung.

Die in Fig. 1 dargestellte Muffe dient zum Verbinden eines glattflächigen Rohres 1, das links oben in Fig. 1 schematisch angedeutet ist, mit einem Leichtgewichtsrohr 2, das rechts oben in Fig. 1 angedeutet ist. Beide Rohre haben den gleichen Durchmesser und die gleiche Wandstärke, wenn man bei dem Leichtgewichtsrohr als Wandstärke die Differenz zwischen dem Außendurchmesser und dem Innendurchmesser des Rohres verwendet. Das Leichtgewichtsrohr 2 ist tatsächlich aus zwei Schichten aufgebaut, nämlich einem inneren glatten zylindrischen Rohr und einem außen angeordneten gewellten Rohr, das zwischen rippenartigen Vorsprüngen 3 umlaufende Nuten 4 bildet.

Die Muffe enthält eine innere Hülse 5, die vollständig glatt ausgebildet ist. Die Wandstärke der inneren Hülse nimmt an beiden Stirnseiten etwas ab. Koaxial zu der inneren Hülse 5 ist eine äußere Hülse 6 angeordnet, die mit der inneren Hülse durch einen zwischen beiden Hülsen vorhandenen Ringsteg 7 verbunden ist. Zwischen der inneren und der äußeren Hülse entsteht dadurch je ein Ringraum 8, 9, von denen jeder Ringraum zu einer Stirnseite der von den beiden Hülsen gebildeten Muffe hin offen ist. Da beide Hülsen 5, 6 kreiszylindrisch ausgebildet sind, weisen beide Ringräume 8, 9 überall die gleiche radiale Abmessung auf. Die innere Hülse 5 bildet die Innenwand 10 jedes Ringraums 8, 9, während die äußere Hülse 6 die Außenwand 11 der beiden Ringräume 8, 9 bildet. Die Ringräume 8, 9 können aber auch unterschiedlich sein.

Die Außenwand 11 des in Fig. 1 linken Ringraums 9 weist eine nach außen gerichtete Sicke 12 auf, die sich über einen vollständigen Umfang erstreckt und dadurch an der Innenseite der Außenwand 11 eine ringförmige Nut 13 bildet. In dieser Ringnut 13 kann ein Dichtelement eingesetzt werden.

Zum Abdichten des Leichtgewichtsrohres 2 kann in die zwischen den Vorsprüngen 3 gebildete Nut 4 ebenfalls ein Dichtelement eingesetzt werden.

Die beiden Rohre 1, 2 werden durch die Muffe derart miteinander verbunden, daß die beiden Rohre mit ihren Stirnkanten in die Ringräume 8 bzw. 9 eingeschoben werden. Um einen Längenausgleich aufgrund von Temperaturschwankungen zuzulassen, erfolgt das Einschieben nicht so weit, bis die Stirnkanten an dem Quersteg 7 anliegen, jedoch weit genug, damit die Rohre fest in der Muffe gehalten werden. Die Muffe kann so dimensioniert werden, daß die beiden Rohre durch Vorspannung kraftschlüssig in der Muffe gehalten werden. Auch eine Vorspannung mit Schellen ist möglich.

Die in Fig. 1 dargestellte Ausführungsform der Muffe dient zum Verbinden zweier Rohre gleichen Durchmessers und gleicher Wandstärke. Soll mit der Muffe eine Verbindung zwischen zwei glattflächigen Rohren 1 erfolgen, so würde auch der in Fig. 1 rechte Ringraum 8 eine Ringnut 13 für ein Dichtelement aufweisen.

Soll andererseits die Muffe zur Verbindung zweier Leichtgewichtsrohre verwendet werden, so würde in beiden Ringräumen 9 eine glattflächige Außenwand 11 vorhanden sein.

Wird mit einer Muffe, wie sie in Fig. 1 dargestellt ist, eine Verbindung zwischen zwei Rohren gleichen Durchmessers aber unterschiedlicher Wandstärke durchgeführt, so wird die Muffe so ausgebildet, daß die innere Hülse 5 wiederum glattflächig ist, während die Wanddickenunterschiede durch die äußere Hülse 6 ermöglicht werden.

Fig. 2 zeigt eine Muffe, mit der zwei Rohre unterschiedlichen Durchmessers miteinander verbunden werden können. Wiederum enthält die Muffe für jedes Rohrende einen Stutzen 14, der doppelwandig ausgebildet ist, so daß zwischen der jeweiligen Innenwand 10 des Ringraums 8 bzw. 9 und der zugehörigen Außenwand 11 ein Ringraum gebildet ist, der zum Ende der Muffe hin offen ist.

Auch hier ist die Muffe an ihrer Innenseite glattflächig ausgebildet, das heißt, daß hier keine Stirnflächen oder nach außen gerichtete Hinterschneidungen auftreten.

Die Ausführungsform nach Fig. 3 zeigt eine Muffe, mit der zwei Rohre gleichen Durchmessers miteinander verbunden werden können, die in geradliniger Verlängerung angeordnet sind. Hierzu ist ein in Fig. 3 nach oben gerichteter Stutzen 14 und ein nach unten gerichteter Stutzen 40 vorgesehen. Die Muffe enthält zusätzlich eine Abzweigung 15, die ebenfalls als Stutzen 14 ausgebildet ist. An dieser Abzweigung kann ein drittes Rohrende eines zu verbindenden Rohres befestigt werden, wobei auch hier wieder ein Ringraum 8 bzw. 9 zwischen einer Innenwand 10 und einer Außenwand 11 gebildet ist.

Patentansprüche

1. Anordnung zum Verbinden mindestens zweier Rohre miteinander, insbesondere im Abwasserbereich, im Druckwasserbereich und bei Kabelschutzrohren, enthaltend

   1.1 eine Muffe, die

   1.2 für das Ende jedes zu verbindenden Rohres (1, 2) einen zylindrischen Stutzen (14) aufweist, der

   1.3 mindestens im Bereich seines freien Endes

doppelwandig ausgebildet ist, wobei

1.4 der zwischen der Außenwand (11) und der Innenwand (10) gebildete Ringraum (8, 9) zur Aufnahme des Rohrendes bestimmt ist und

1.5 die Muffe eine glattflächige Innenwand aufweist

2. Anordnung nach Anspruch 1, bei der die radiale Abmessung des Ringraums zu (8, 9) konstant ist und der Dicke des Rohrendes entspricht.

3. Anordnung nach Anspruch 1 oder 2, bei der zur geradlinigen Verbindung zweier Rohre (1, 2) die Innenwände (10) der beiden Stutzen (14) ineinander übergehen.

4. Anordnung nach Anspruch 3, bei der die Ringräume (8, 9) durch einen radialen Steg (7) getrennt sind.

5. Anordnung nach einem der vorhergehenden Ansprüche, bei der zur geradlinigen Verbindung zweier Rohre (1, 2) gleicher Wandstärke die Außenwände (11) der beiden Stutzen (14) ineinander übergehen.

6. Anordnung nach einem der vorhergehenden Ansprüche, bei der eines der zu verbindenden Rohre (1) eine glattflächiges Rohr ist.

7. Anordnung nach Anspruch 6, bei der eine der beiden Wände (10, 11), vorzugsweise die Außenwand (11) des Ringraums (9) eine in den Ringraum hin offene Ringnut (13) zur Aufnahme eines Dichtelements aufweist.

8. Anordnung nach einem der vorhergehenden Ansprüche, bei der mindestens eines der zu verbindenden Rohre ein Leichtgewichtsrohr (2) ist.

9. Anordnung nach Anspruch 8, bei der in einem Ringraum (4) zwischen zwei Rippen (3) des Leichtgewichtsrohres (2) ein Dichtelement angeordnet wird.

10. Anordnung nach einem der vorhergehenden Ansprüche, mit einer Abzweigung (15) zur Verbindung eines dritten Rohres.

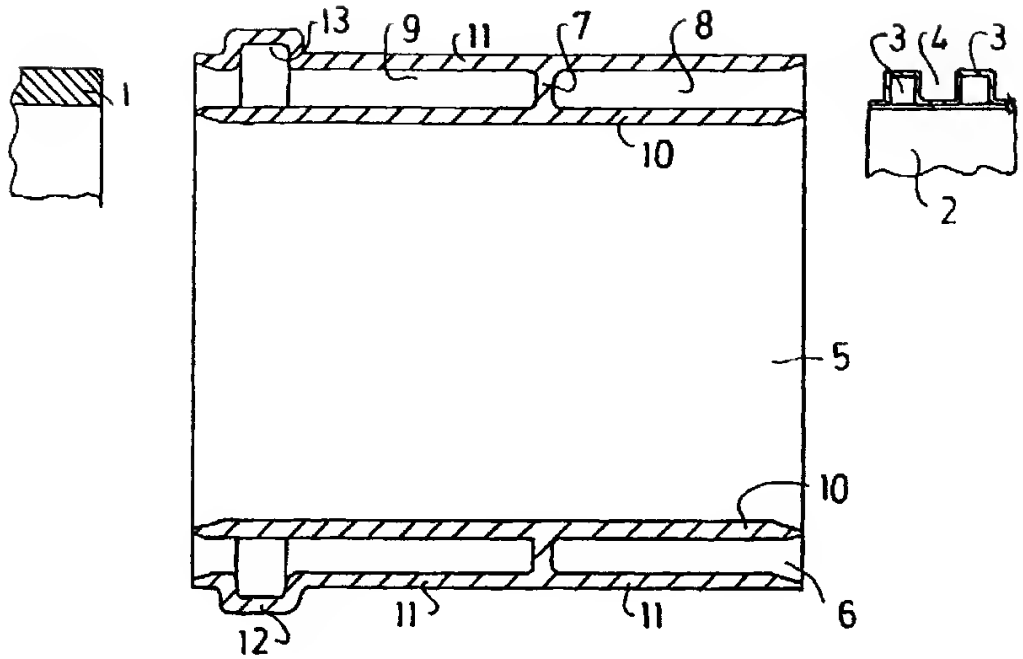

FIG. 1

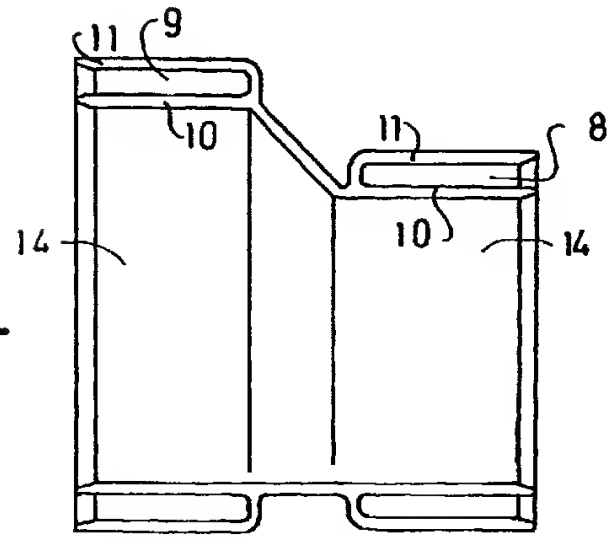

FIG. 2

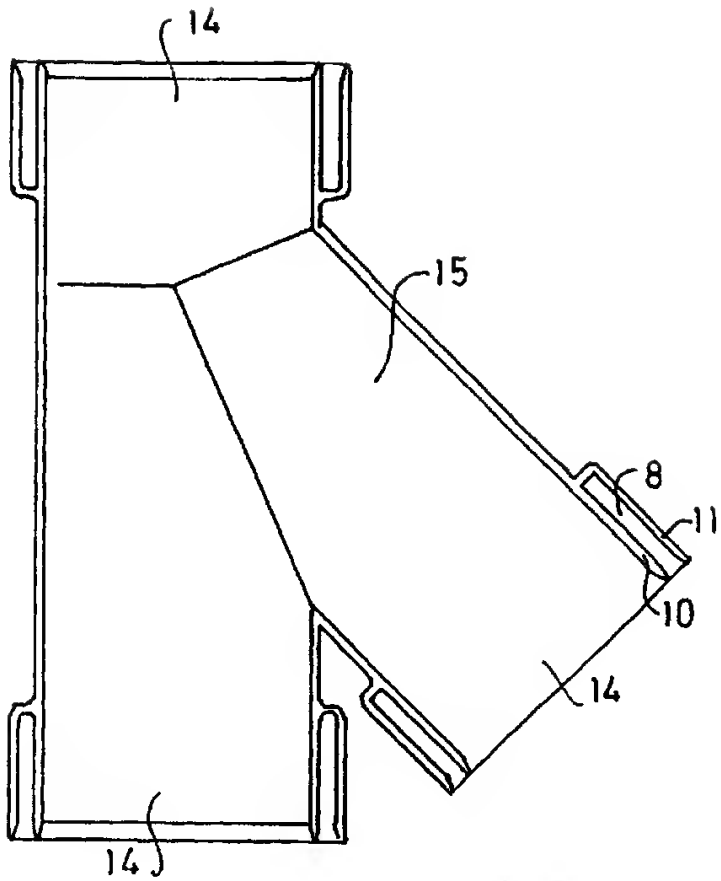

FIG. 3

Europäisches Patentamt

EUROPÄISCHER RECHERCHENBERICHT

Nummer der Anmeldung
EP 98 10 7783

EINSCHLÄGIGE DOKUMENTE

Kategorie	Kennzeichnung des Dokuments mit Angabe, soweit erforderlich, der maßgeblichen Teile	Betrifft Anspruch	KLASSIFIKATION DER ANMELDUNG (Int.Cl.6)
X	DE 44 42 407 C (CENTROTHERM GMBH) 14.November 1996 * Abbildung 2 *	1-3,6,8	F16L21/00 F16L25/00
X	US 1 762 766 A (DE GARAY) 10.Juni 1930 * Abbildungen *	1-6,8	
X	DE 19 37 176 A (J. SPECHT KG) 4.Februar 1971 * Abbildungen 2,3 *	1-9	
X	US 4 099 749 A (VAN VLIET CORS) 11.Juli 1978 * Abbildungen *	1-6,8	
A	EP D 385 465 A (OLTMANNS KUNSTSTOFFWERK GMBH) 5.September 1990 * Abbildung 3 *	9	

RECHERCHIERTE SACHGEBIETE (Int.Cl.6)

F16L

Der vorliegende Recherchenbericht wurde für alle Patentansprüche erstellt

Recherchenort	Abschlußdatum der Recherche	Prüfer
DEN HAAG	9.Juli 1998	Budtz-Olsen, A

KATEGORIE DER GENANNTEN DOKUMENTE

X : von besonderer Bedeutung allein betrachtet
Y : von besonderer Bedeutung in Verbindung mit einer anderen Veröffentlichung derselben Kategorie
A : technologischer Hintergrund
O : nichtschriftliche Offenbarung
P : Zwischenliteratur

T : der Erfindung zugrunde liegende Theorien oder Grundsätze
E : älteres Patentdokument, das jedoch erst am oder nach dem Anmeldedatum veröffentlicht worden ist
D : in der Anmeldung angeführtes Dokument
L : aus anderen Gründen angeführtes Dokument

& : Mitglied der gleichen Patentfamilie, übereinstimmendes Dokument

EPO FORM 1503 03.82 (P04C03)

(12) UK Patent Application (19) GB (11) 2 011 001 A

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4 Jul 1979
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F16L 21/04
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GB 1530749
GB 1360863
GB 1192579
GB 986889
GB 939341
GB 819210
GB 784791
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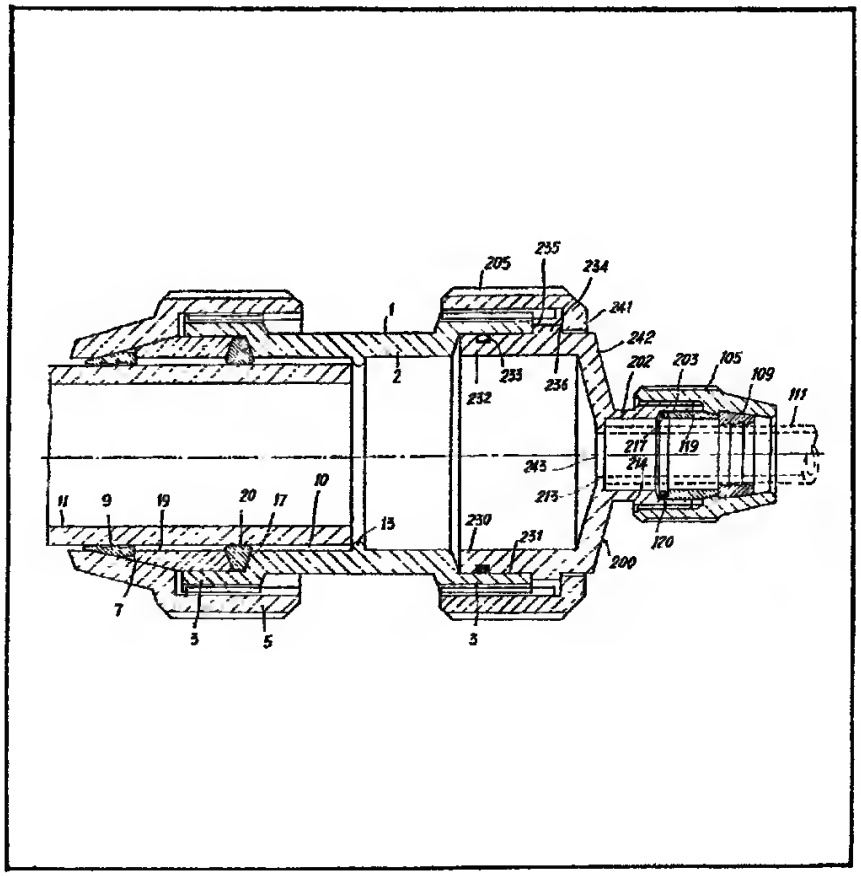
F2G
(71) Applicant
F.I.P. Formature Iniezione Polimeri SpA Ceselle (Genoa) Italy
(72) Inventors
Giancarlo Bonissone,
Piero Mules
(74) Agent
Merks & Clerk

(54) Reducer Coupling

(57) A reducer 200 for coupling pipes 11, 111 of different diameter comprises a first hollow cylindrical body 230 with an external annular rib 234 to limit insertion of the body 230 into a bore of an externally threaded coupling member 1 joined to the wider pipe 11 and to abut with an inner flange 241 of an internally threaded sleeve 205 screwed on to the coupling member 1 to join the reducer 200 to the coupling member 1, an annular wall 242 at that and of the hollow cylindrical body 230 opposite the end inserted into the coupling member 1 joining the body 230 to a second hollow cylindrical body 202 for receipt of the pipe 111 coaxial with the first body. Pipes 11, 111 are each held by a joint comprising a clamping ring 9, 109, a sealing ring 20, 120 and a spacing ring 19, 119 compressed axially by a tapered nut 5, 105.



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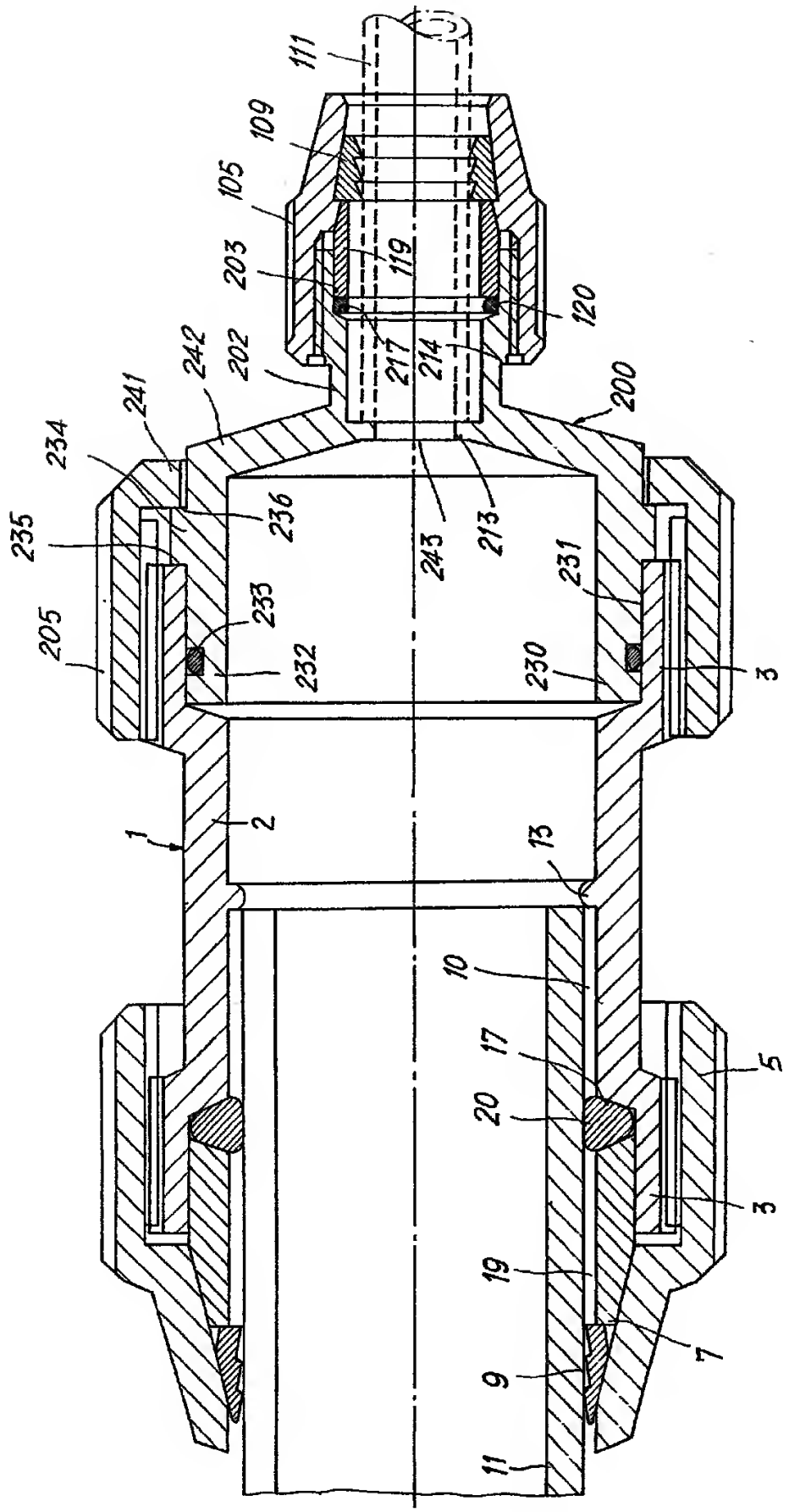
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SPECIFICATION
Reducer Coupling

The present invention relates to reducer couplings, and to reducers for use in such couplings. The present reducer couplings can be used for coupling pipas which are of different diameter and made for example of metal or thermoplastics.

In the specification of our application No. 18926/77, Serial No. 1530749, we have described and claimed a coupling comprising a cylindrical body provided at its ends with external scraw threads, two bushes edapted to be screwed onto the ands of said body and provided with frustoconical inner and surfaces, two radially slit rings of wadge-shapad cross section adapted to abut with the raspactive frustoconical innar surface of each bush end providad with inner toothed surfacas adaptad to grip the end of a pipe inserted therein, said body having at aach and a bore widar than tha cantral portion of the body and dafining an annular abutment surfece with said central portion, two axially alongated rings baing axially slidable within said boras and an annular seal baing arrangad betwaan seid alongated rings, and said abutment surfece.

Such a coupling according to our earlier epplication will thus typically consist of a cylindrical body, also refarrad to harain as e coupling mambar, two thraadad bushas, two annular seals usually in the form of elastic O-rings, and two radlelly slit tightening rings with a wedge-like cross section cut along a radial plene, as well es two intermediate elongete rings providad batwean the O-rings and the wedge-like tightaning rings. That is a total of nina alements for connacting pipas having the same diameter.

It is to be appraciated that the cylindrical body may be variously shaped in known manner, e.g. instaad of being straight it may have an elbow shape, comprise ona or more T or cross branches, and so on.

When pipes of different diameters ere to be connected, it is thus necessary to have for said cylindrical body particular constructiva elements in large number, in fact for any type of cylindrical body the various solutions corresponding each to a particular reduction must be availabla.

For instance, for a straight or elbow sleeve all the possibla combinations between the diameters of the pipes connected to the two ends of the coupling must be available.

Further, when the slaeve has a T-shape, the combinations increase in number, therafore the necessary stock for all the possible reducers makes the cost high.

The object of the presant invention it to avoid this drawback, by providing a reduction element which may be manufactured as a single set for use with any type of cylindrical body.

According to the present invention, we provide a reducer for use in a coupling employed to couple pipes of different diamatar, the reducer external annular rib to limit insertion of the body into a bore of an externally threadad coupling member and to abut with an inner flange of an internally threaded sleeve intended to be screwed on to the coupling member to join the reducer to the coupling member, an annular wall at that end of the hollow cylindrical body being the opposite end to that which is to be inserted into the coupling member and from which wall extends a second hollow cylindrical body coaxial with the first hollow cylindrical body and having a first bora at its free end of smaller diemeter than the internal diameter of the first hollow body and defining an annular abutment surface with a second bore of tha second hollow cylindrical body of smaller diameter than the first bora.

The free and of the sacond body of said reducer is thus like one of the two symmatrical halvas of the cylindrical body provided for e coupling according to tha previous application, but with a smeller diameter than the coupling member in which the first body of the reducer is inserted.

In consequance tharaof, according to the present invention only thraa additional elaments (raducer, bush end O-ring saal) are necassary for a good saal in any raduction casa, as tha elemants considered by tha pravioua spacification may ba used for completing tha connection of pipes of different diametars. The O-ring saal is preferably achiaved using an O-ring in an annular groova on the extarnal surfaca of tha first hollow body, tha groova being on that side of tha rib remote from tha annular wall.

An embodiment of tha present invention will now ba describad by way of exampla, with refarence to the accompanying drawing wherein:— the single figure shows a vartical section of a reducer according to tha invention for a reducer coupling.

The central body 1 of a coupling comprisas at ona end, and as dascribed in our earlier application, an enlargad saction 3 defining an annular counterboring surface 17 for a sealing elastic ring 20. The said one end of said central body 1 is threaded outsida for receiving an internally bush 5 whose free end defines a frustoconical inner surface 7. Tha frustoconical surface 7 is arranged to act against tha conical surface of a clamping ring 9 provided with a radial slot allowing same to tighten under the action of said clamping conical surface 7. The clamping ring 9 is providad inside with teeth (which may be knurlings) suitable to allow good clamping of a pipe 11 resting with its and against an annular rib 13 provided in en intermediate position on the inner surface of said cantral body 1.

An intermediate elongete ring 19, whose object is to increase the axial movement of said bush 5 on the centrel body 1 through screwing and thus allow compensation for larger tolarances of the outer diameter of pipe 11, is provided between the sealing elastic ring 20 and the clamping ring 9.

Therefore, the left portion of the figure shows a

wherein elements 5, 9, 19 and 20 correspond to a given diameter of said pipe 11.

The reducer 200 according to the present invention allows to connect in a safe sealing and mechanical way a pipe 111 of smaller diameter than pipe 11 using, besides said central body 1 and reducer 200, analogous elements 115, 109, 119 and 120 of a coupling according to the previous application, but dimensioned for the diameter of pipe 111.

To this end, the reducer 200 according to the invention comprises a first cylindrical hollow section 230 whose outer surface 231 has an outer diameter substentially equal to the inner diameter of the widened section 3 of the other end of said central body 1, so as to be suiteble to be inserted therein in tha manner shown. On said outer aurface 231 ia provided an annuiar groove for houaing an elestic ring 233 having the object of sealing tha outer aurfaca 231 end tha inner surface of the widenad saction 3 of the central body 1.

On the outer surfece of the cylindricel section 230 is providad a rib 234 which beers egainst the end edge of said central body 1 through a first annular abutment surface 235; the second such surface 236 of the rib 234 receives the inner flange 241 of e sleave 205 thraeded inelde end which ia ecrewed on to the threeding provided on the outer threaded surface of the widened section 3 of the said other end of the cantral body 1.

The outwardly diracted end of the cylindrical hollow body 230 is closed by e well 242 provided at its centre with a bore 243. Beyond the wall 242, the reducer 200 comprises a sleave-shaped or second hollow cylindrical body 202, whose form is the same as half of the central body 1 in the drawing, but heving a size suiteble to the diameter of pipe 111.

To this end, the second cylindrical body 202 of the reducer 200 comprises at its innarmost end an abutment annuler rib 213, similar to rib 13 of said central body 1, a widened section 203 defining an abutment surface 217 for a sealing elastic ring 120 corresponding to the alastic ring 20 of seid central body 1, the section 203 receiving an elongate ring 119 corresponding to said elongete ring 19, as well as a clamping ring 109 and e threaded bush 105, corresponding to the clamping ring 9 end to the bush 5 of said central body 1 respectively.

Clearly, said elements 1, 5, 9, 19 and 20 are elements of a coupling according to the previous application suitable for the diameter of a pipe 11, while the elements 105, 109, 119 and 120 are elements of a coupling according to the previous applicetion suitable for the diameter of a pipe 111.

Therefore, a reducer kit of the present invention in preferred form consists of only three items, i.e. the reduction body 200, the threaded bush 205 and the sealing elastic ring 233.

It is to be appreciated that such a kit should be provided for all the possible combinations of the diameter of a larger pipe 11 and of a smaller pipe 111.

Further, the shape of said central body 1 is of no importance, as it may be shaped as a sleeve, or es an elbow, as a T joint, as e cross joint and so on, without any need of modifying the set of pieces forming the reducer, unless the ratio of the diameters of the pipes is altered.

Claims

1. A reducer for usa in a coupling employed to couple pipes of different diameter, the reducer comprising a first hollow cylindrical body with en externel ennular rib to limit insertion of the body into a bore of en externelly thraaded coupling member and to abut with en innar flange of en internally threaded sleeve intendad to be screwed on to the coupling member to join the reducer to the coupling member, en ennular wall et that end of the hollow cylindrical body being the opposite end to thet which ia to be inserted into the coupling member and from which well extends e second hollow cylindricel body coaxial with the first hollow cylindricel body end having a first bore et its free end of smaller diameter then the internal diameter of the first hollow body and defining an annuler abutment surface with a second bore of the second hollow cylindrical body of smeller diemetar than the first bore.

2. A reducer as claimed in Claim 1 with en annuler groove on the externel surfece of the first hollow body, tha groove baing on that aida of the rib remote from the ennuler well.

3. A reducer as claimed in Claim 2 with an O-ring in the groove.

4. A reducer as claimed in any one of Claims 1 to 3 together with the internally threaded sleeve for screwing on to the coupling member.

5. A set of reducers, each reducer being as claimed in Claim 1 but differing from each other in the internal diameter of the first hollow cylindrical body and/or in the diameter of the first bore of the second hollow cylindrical body.

6. A reducer coupling comprising a coupling es defined in Claim 1 of application No. 18926/77 with a reducer and sleeve as defined in Claim 4, the two bushes, two slit rings, two elongate rings end two annular aeals of the coupling being dimensioned as e first set of elements to suit one end of the cylindrical body of the coupling and as a second set to suit the free end of the second body of the reducer.

7. A reducer coupling substantially as hereinbefore described with reference to the eccompanying drawing.

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Steinhardt et al.

[11] Patent Number: 5,701,388

[45] Date of Patent: Dec. 23, 1997

3

[54] **COMBINED HEATER AND PUMP**

[75] Inventors: **Michael D. Steinhardt**, Kiel; **Isadore Balan**, Mequon; **Kenneth J. Sieth**, Delafield, all of Wis.

[73] Assignee: **Kohler Co.**, Kohler, Wis.

[21] Appl. No.: 362,671

[22] Filed: Dec. 22, 1994

[51] Int. Cl.[6] F24H 1/08

[52] U.S. Cl. 392/471

[58] Field of Search ..... 392/471, 476, 392/503, 360, 379, 396, 398; 219/202, 205, 206, 207, 208, 209, 400; 310/68 R; 261/142

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Primary Examiner—Tu B. Hoang

Attorney, Agent, or Firm—Quarles & Brady

[57] **ABSTRACT**

A compact combined heater and pump is disclosed. There is a pump housing forming an internal pump chamber, the housing having both an inlet and an outlet and an opening therethrough. A drive shaft is rotatably mounted in the opening and is driven by a motor located outside the chamber. An impeller is mounted on the drive shaft within the housing and a heater is sandwiched in the chamber between the motor and impeller. Rotation of the shaft can draw liquid in from the inlet, past the heater and through the outlet. A cooling fan attached to the shaft for rotation therewith draws cooling air over control circuitry and then forces the air over the motor.

23 Claims, 4 Drawing Sheets

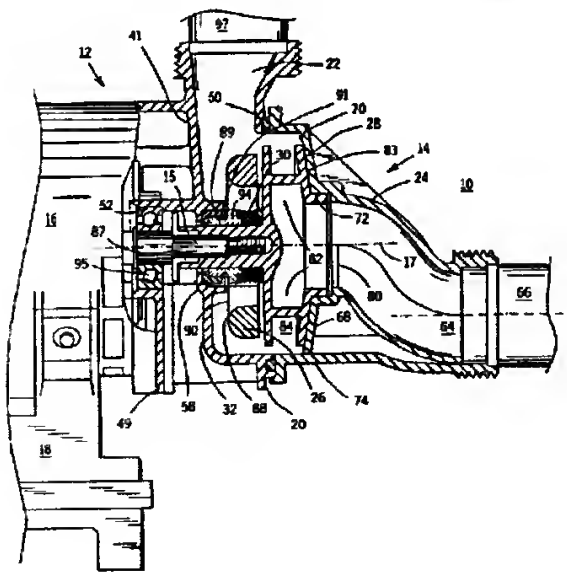
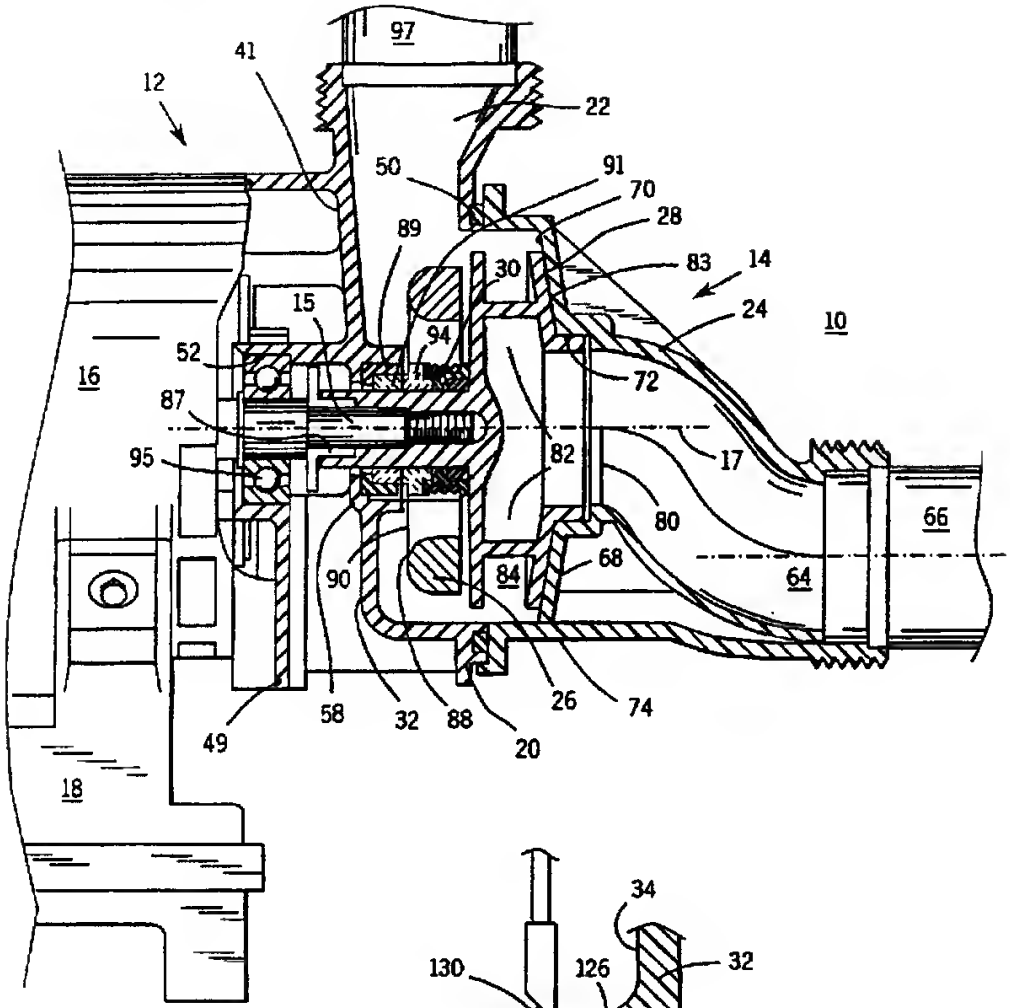


FIG. 1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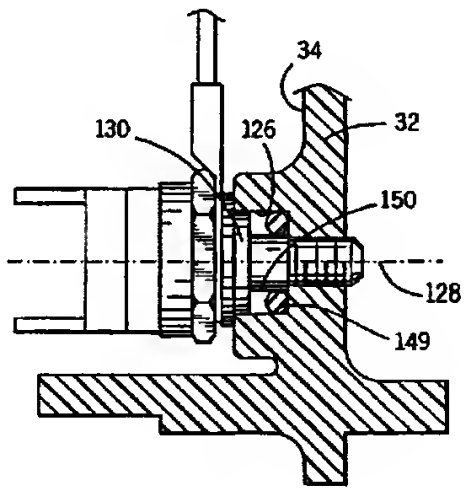
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FIG. 6

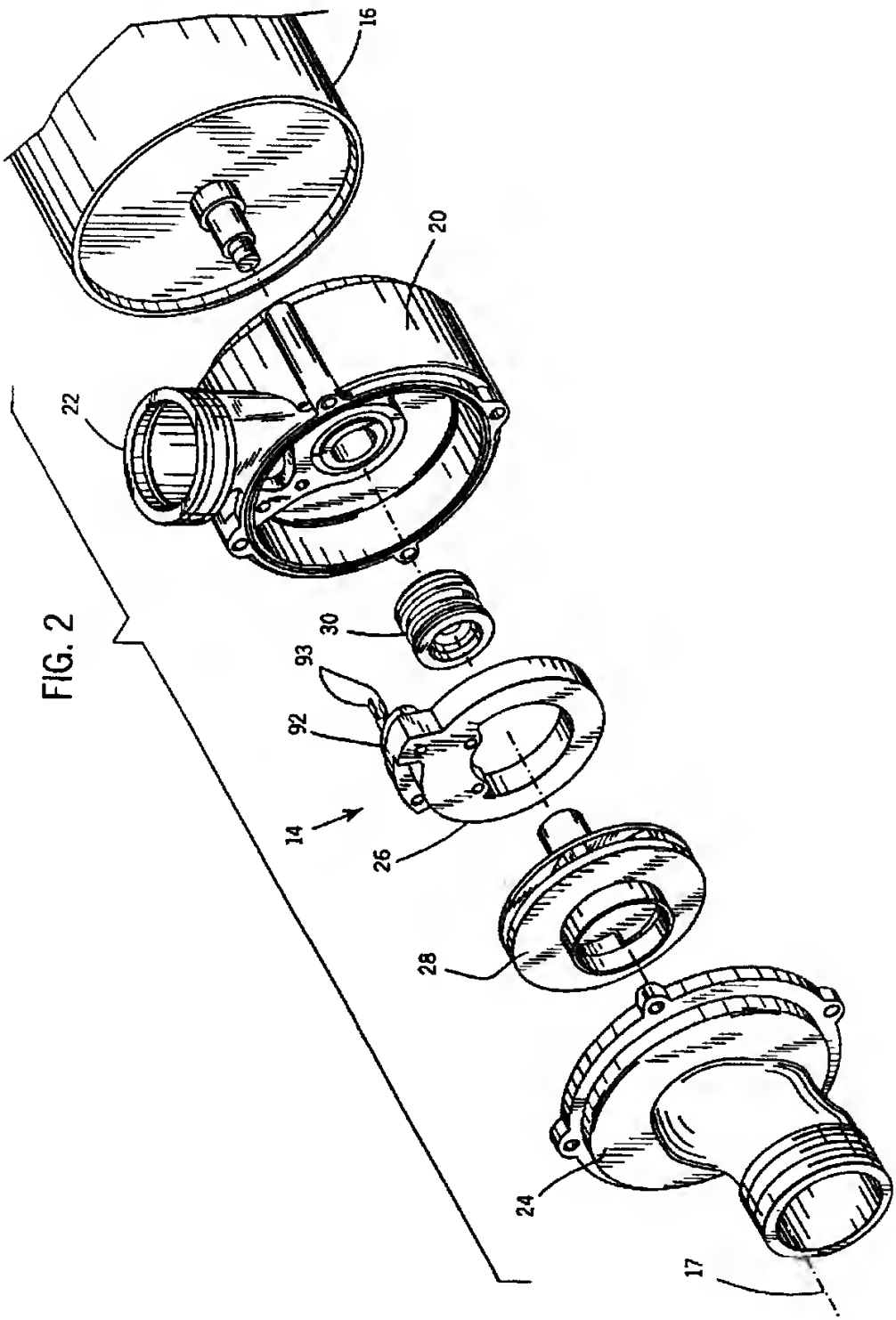

FIG. 2

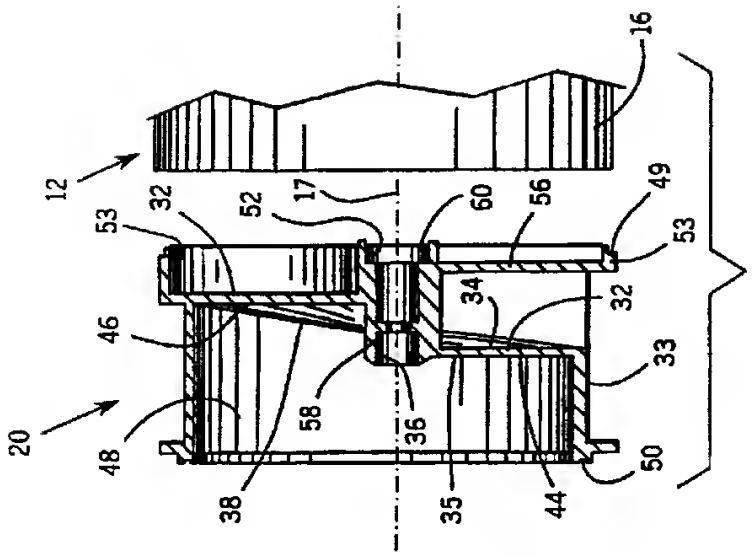
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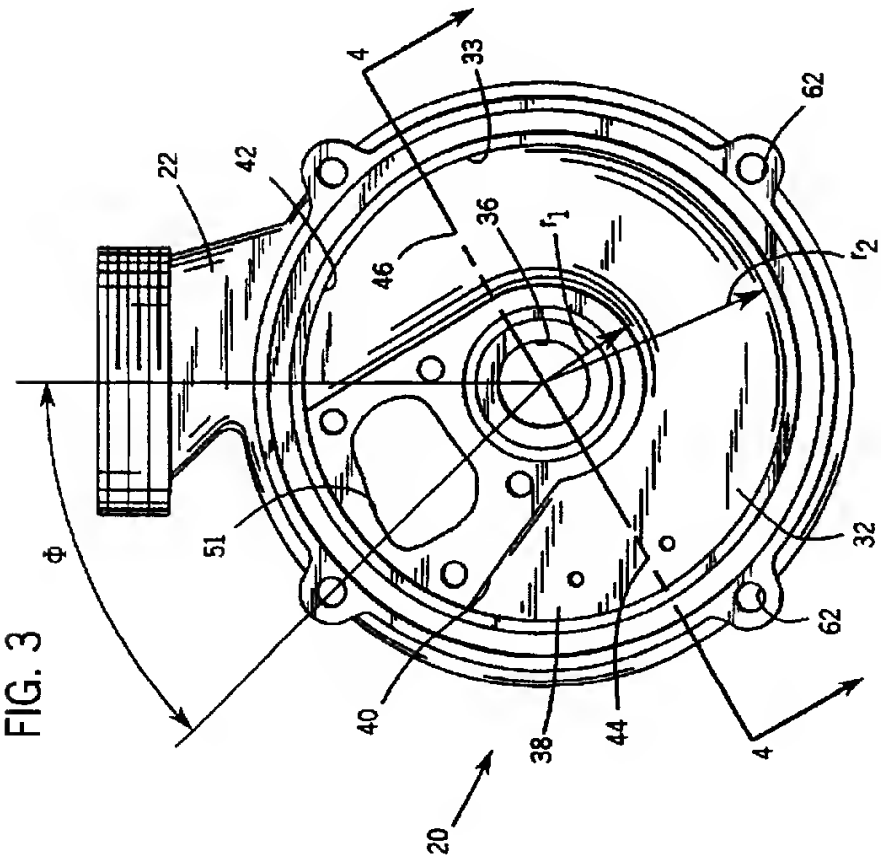
FIG. 4


4
33
62
22
42
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r_1
r_2
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FIG. 3

FIG. 5

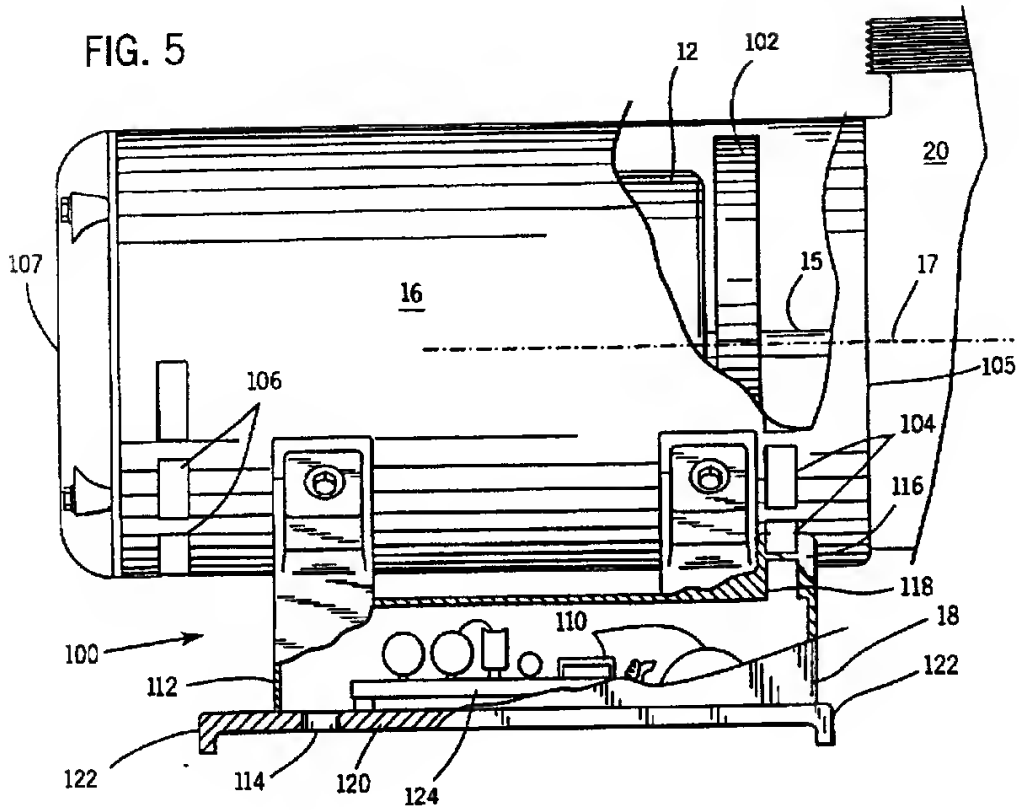
12
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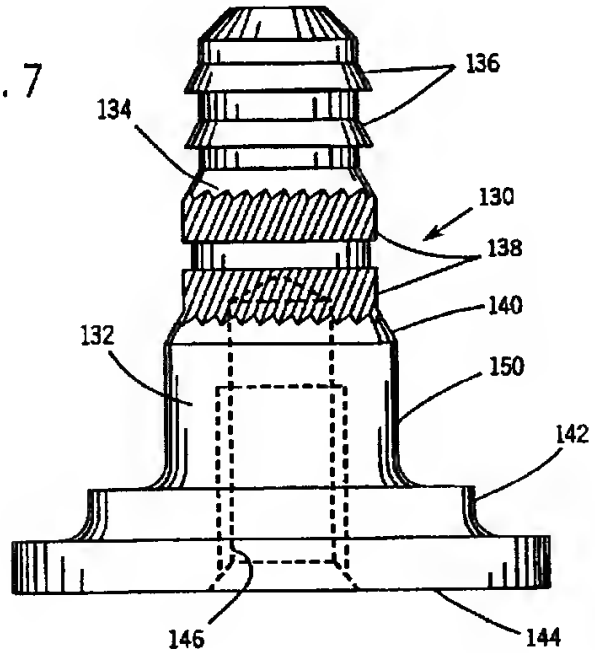
FIG. 7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COMBINED HEATER AND PUMP

FIELD OF INVENTION

The present invention relates to pumps and more particularly to a compact pump and heater for a spa or the like.

DESCRIPTION OF THE ART

It is often desirable to provide large whirlpool tubs within a relatively confined area. This is particularly true where a whirlpool system is to replace a conventional tub and must fit within an existing tub alcove. Complicating matters, a whirlpool tub must share alcove space with "hidden" whirlpool system components such as a pump, pump motor, a heating unit, control circuitry, and additional plumbing to direct water to and from the pump unit, heating unit, and tub.

It is also desirable to configure a whirlpool system so that all of the hidden components are located in a single area of the alcove. Proximate placement of components permits all components to more easily be serviced from a single port and limits the amount of plumbing required to route water.

U.S. Pat. No. 4,594,500 describes one relatively economical and serviceable pump/heating configuration wherein a pump element and a heating element are included in a single unit. Unfortunately, this design is not much smaller than the two housings it replaces.

Another problem is that during operation both the motor and control circuitry generate heat. If the heat is not dissipated properly, it can drive the operating temperature of both the motor and control circuitry outside the ideal range and eventually damage or destroy the motor and/or circuitry. By placing the motor and control circuitry within a single confined space the overheating problem is exacerbated as heat is trapped near the motor and circuitry. Furthermore, placing the heating unit in the same confined area as the motor and control circuitry would be thought to exacerbate the overheating problem.

U.S. Pat. No. 5,006,743 describes a well known fan unit which rotates with a motor shaft to cool the motor during operation. While a motor fan may sufficiently cool the motor, it does little to dissipate control circuitry heat.

Therefore, it would be advantageous to have a whirlpool system including a pump unit, heating unit, motor and control circuitry that together require minimal space. In addition, it would be desirable to have such a system that includes both a motor and control circuitry cooling mechanism.

SUMMARY OF THE INVENTION

The present invention resides in a pump for pumping and heating a liquid, the pump being drivable by a motor. In one embodiment, there is a pump housing having an internal pump chamber, a fluid inlet into the chamber, a chamber sidewall, and a radial outlet, the sidewall having an opening therethrough. The pump includes a drive shaft which is rotatably movable within the opening and is suitable to be attached to a motor located outside the chamber. An impeller mounted on the drive shaft rotates therewith in the chamber. A heater is sandwiched in the chamber between the sidewall and the impeller. Upon operation of the pump and connection of the pump to a fluid supply, rotation of the shaft draws liquid in from the inlet, past the heater and through the outlet.

In one embodiment the inlet opens into the chamber at a position opposite the side wall opening. In another embodiment, a ball bearing is included within the opening for receiving and supporting the drive shaft, a portion of the pump chamber may take the form of a volute for increasing water pressure prior to the outlet, and the heater is donut-shaped and surrounds the drive shaft.

In yet another embodiment, the pump includes an insert that is forced through the pump housing by ultrasonic vibrations, the insert having a sensing end extending into the pump chamber and a distal end located outside the pump chamber. An O-ring may be included at the junction between the insert and the pump housing for providing a seal. In addition, a sensor may be connected to the distal end of the insert and the insert may be thermally and electrically conductive. The sensor may be either a water temperature or water presence sensor.

In another embodiment, a gland is included outside the pump chamber on the pump chamber wall, the gland surrounding at least a portion of the insert and having an internal surface which opposes an external surface of the insert. The O-ring fits tightly between the internal and external surfaces.

In yet another embodiment the motor is enclosed in a motor housing having at least one air intake and a circuit housing is positioned adjacent the motor housing near the intake. The control circuitry for the motor and pump are positioned within the circuitry housing. The circuitry housing includes a chimney chute at a first end that communicates with the intake and an intake hole at a second end opposite the first end. A fan is included within the motor housing that forces air through the intake hole, over the control circuitry, through the chimney chute and intake, and over the motor.

As will be apparent from the description below, the present invention allows a user to increase the volume of a whirlpool tub by minimizing the space required for certain hidden components of a whirlpool system. The user may provide a whirlpool tub having a comfortable size even in a relatively small alcove. In addition, even a small existing alcove need not be specially altered to receive a whirlpool system including components designed according to the present invention. Furthermore, overheating problems involving the motor and control circuitry can be minimized even where all of the hidden components are located in a relatively small area.

The objects of the invention therefore include providing a heater/pump assembly of the above kind:

(a) which is inexpensive to produce;

(b) which requires a minimal amount of space;

(c) wherein the system is designed to cool both motor and control circuitry;

(d) which provides a watertight ultrasonic insert for use with a liquid pump; and

(e) which is easy to service and maintain.

The foregoing and other objects and advantages of the invention will appear from the following description. In the description, reference is made to the accompanying drawings which form a part hereof, and in which there is shown by way of illustration preferred embodiments of the invention. Such embodiments do not represent the full scope of the invention. Reference is made therefore to the claims herein for interpreting the full scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an axial sectional view through a pump/heater unit embodying the present invention;

FIG. 2 is an exploded view of certain of the components of the pump/heater unit of FIG. 1;

FIG. 3 is an end elevational view of the pump housing according to the invention;

FIG. 4 is a cross-sectioonal view taken along the line 4—4 of FIG. 3;

FIG. 5 is a partial cross-sectional view of a motor including a separate circuit housing according to the present invention;

FIG. 6 is an enlarged view of the ultrasonic insert shown in FIG. 1; and

FIG. 7 is an enlarged view of an ultrasonic insert.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to FIG. 1, a pumping arrangement 10 embodying the present invention includes, as its main components, a motor 12 and a pump/heater unit 14 which is mounted to the motor 12.

The motor 12 is of any known construction and includes a motor housing 16 which is supported by means of a mounting arrangement 18. In the following discussion, it will be assumed, unless otherwise indicated, that the motor housing 16 will be mounted on the mounting arrangement 18 in the illustrated position, that is, on a substantially horizontal surface of support. The motor 12 includes a drive shaft 15 which extends from the motor housing 16 for rotatable motion about an axis of rotation 17.

Referring also to FIG. 2 the pump/heater unit 14 consists primarily of a pump housing 20, a housing lid 24, a heater 26, an impeller 28, and a seal spring 30. Preferably, the pump housing 20, lid 24, heater 26, impeller 28, and spring 30 are arranged around the axis of rotatiou 17.

Referring also to FIGS. 3 and 4, the pump housing 20 includes a base wall 32 having a substantially circular shape when viewed from an end elevational position and a cylindrical outer wall 33 which extends from the circumferential edge of the base wall 32 perpendicular to the axis of rotation 17 and in a direction away from the motor 12. The base wall 32 has an internal face 34 which faces the motor and an external face 35 facing in the opposite direction. An opening or hole 36, which is centered on the axis of rotatiou 17, is provided in the base wall 32. Preferably, a volute channel 38 is formed in the external face 35.

Referring specifically to FIG. 3, in the preferred embodiment, the volute channel 38 begins at an angle Φ (approximately 45°) from vertical and wraps around the hole 36 (through approximately 225°) to a point at which it follows a tangent to a lateral edge of the internal face 34. The internal r_1 and external r_2 radii of the channel 38 are constant throughout the wrapping portion of the channel 38. The depth of the channel 38 increases throughout its wrapping portion, being relatively narrow at an inlet end 40 and relatively deeper at an outlet end 42.

Referring also to FIG. 4, it can be seen that the channel 38 is one depth at a cross section 44 near the inlet end 40 and a deeper depth at a different cross sectional area 46 near the outlet end 42. A heater aperture 51 is provided in the portion of the base wall 32 that does not form the volute 38 (i.e. between the outlet 42 and the inlet 40 ends of the volute channel 38).

Central and outer support cylinders 52, 53 extend from the base wall 32 toward the motor 12 and are centered on the central axis 17. The central cylinder 52 circumscribes the hole 36, extending from the internal surface 34 of the base wall 32. Around a portion of the pump housing 20 where the volute channel 38 is relatively deep, the outer cylinder 53 extends from an external edge of the base wall 32. Where the volute channel 38 is relatively shallow, an additional support member 56 extends radially from the central cylinder 52 to support the outer cylinder 53. A recess 49 is provided on the external surface of the outer cylinder 53 along the cylinder's distal edge.

Referring still to FIG. 4, both an annular hub 58 and an annular recess 60 are provided on the internal surface of the central cylinder 52. The nub 58 is located approximately centrally within the cylinder, extends radially inwardly, and provides support for various sealing components as will be described in more detail below. Referring also to FIG. 1, the recess 60 is located on the edge of the internal surface of the cylinder 52 facing the motor 12 and provides support for a ball bearing 95 which is of a construction well-known in the art.

Referring again to FIGS. 1, 2, and 3, the pump housing 20 also includes an outlet channel 22 which extends radially from the pump housing 20. As best seen in FIG. 3, the outlet channel 22 is aligned with the outlet end 42 of the volute channel 38 so that liquid flowing in the volute channel 38 naturally proceed out the outlet channel 22. The pump housing 20 also includes four bolt holes 62 which are used to fasten the housing adjacent a motor.

Referring now to FIGS. 1 and 2, the housing lid 24 has an axially extending inlet nipple 64 which can be attached to an inlet pipe 66 in any known manner. The lid 24 includes a lid wall 68 having an internal surface 70 which forms an annular receiving shelf 72 centered on the axis of rotation 17. The lid 24, like the pump housing 20, also has a cylindrical outer wall 74 which extends parallel to the axis of rotation 17. Outer wall 74 extends in the direction of the motor 12. The radii of both the lid and housing cylindrical walls 33, 74 is identical so that when fastened together, a tight seal can be formed therebetween.

Referring to FIGS. 1 and 4, a seal receiving channel 50 is provided on the distal edge of the housing outer wall 33 for receiving an elastomeric O-ring 76. When the lid 24 is installed on the pump housing 20, the elastomeric O-ring 76 is pressed between the distal ends of the outer walls 33, 74 and forms a watertight seal therebetween.

The outer walls 33, 74 together form a pumping chamber 78 which houses the heater 26, impeller 28, and seal spring 30. The impeller 28 is of a known construction having inboard 85 and outboard 83 surfaces and includes an axial inlet 80 extending away from the motor 12, a plurality of impeller vanes 82 and a plurality of substantially radially opening outlets 84. The inlet 80 should be sized so that it fits between, and does not contact, the receiving shelf 72, so that it can freely rotate therein. The impeller 28 also includes a cylindrical shank 86 extending from a side opposite the impeller inlet 80. The shank 86 has a hollow notched bore 87 for receiving the end of the shaft 15. The distal end of the shaft 15 is threaded and the internal surface of the bore 87 is oppositely threaded so that the shaft can be securely screwed to the end of the shank 86. An annular rubber cup gasket 89 is sized so as to snugly fit within the hole 36 on the nub 58. A ceramic mating ring 91 fits within the cup gasket 89. An annular carbon seal ring 94 communicates with the mating ring 91.

Referring to FIGS. 1 and 2, the heater 26 is substantially donut-shaped having an inboard face 88 and an outboard face 90. As best seen in FIG. 2, a single mounting extension 92 extends from the inboard face 88 parallel to the axis of rotation 17. Two electrical contacts 93 extend from the distal end of the mounting extension 92 and are also parallel to the axis of rotation 17.

The heater 26 includes an electrical resistance wire inside a stainless steel tube. Electrical insulation surrounds the wire. Aluminum is cast around the stainless steel tube. The aluminum cast is grounded. As the resistance wire and tube heat up, heat transfers to the aluminum and into water therearound. Importantly, the aluminum acts as an electrical current collector for the entire tub. This eliminates the need for separate current collectors in the tub or pump apparatus. In addition, the aluminum eliminates corrosion of the heating element.

Referring to FIG. 1, the seal spring 30 is a standard helical spring having a diameter that is greater than the diameter of the shank 86 so that the shank 86 fits loosely therethrough. The diameter of the spring should be limited so that it fits within the central support cylinder 52 and is supported by the annular nub 58.

When the pump housing 20 is installed on the end of the motor housing 16, the recess 49 on the distal edge of the outer support cylinder 53 receives an adjacent edge of the motor housing 16. The drive shaft 15 extends through the central cylinder 52, cup gasket 89, mating ring 91, seal ring 94, and the seal spring 30 and is supported by the ball bearing 95. The impeller shank 86 also extends partly through the central cylinder 52 so that the distal end of the shaft 15 is securely received therein. The seal spring 30 is located around the impeller shank 86, with one end anchored on and restricted by the seal ring 94. The second end of the seal spring 30 contacts the inboard surface 85 of the impeller. Thus the spring 30 biases the cup gasket 89, mating ring 91, and sealing ring 94 toward the nub 58 in a direction away from the motor 12.

The heater 26 is positioned between the impeller 28 and the base wall 32 with its inboard surface 88 facing the base wall 32 and its outboard surface 90 facing the impeller 28.

During pump operation, fluid follows along the path indicated by arrow 160 in FIG. 1.

During rotation of the impeller 28 with the distal end of the drive shaft 15, fluid in the inlet pipe 66 is pumped through the inlet nipple 64, through the inlet 80, and impelled by the vanes 82 to move radially outwardly and eventually exits the impeller 28 through the respective outlets 84 to enter the high pressure space or pumping chamber 78 provided around the impeller 28 where the heater 26 is located. As liquid passes by the heater 26, it is heated to a desired temperature.

As known in the art, the volute channel 38 increases the water pressure as the amount of accelerated water is increased. Referring again to FIG. 3, while only a small volume of liquid has a high velocity in the shallow portion of the volute channel 38, a relatively large volume of water has high velocity in the deeper portion of the channel so that, liquid exiting the outlet end 42 forms a high velocity jet. The high velocity jet exits the outlet channel 22 and is directed by an outlet pipe to a desired destination.

By providing the ball bearing 95 within the central support cylinder 52, an end supporting portion of the motor housing which normally includes a supporting ball bearing can be eliminated. Once the end portion of the motor housing 16 is eliminated, the entire area required by the pump and motor housings 16 is reduced.

By placing the supporting ball bearing 95 closer to the motor 12 than would normally be the case, both the heater 26 and volute channel 38 can be positioned around the shaft 15 and sandwiched between the impeller 28 and the motor 12 as opposed to being positioned somewhere else. In this manner, area around the shaft 15 which would normally include the end portion of the motor housing can accommodate necessary components of the heater/pump unit 10.

By sandwiching the heater 26 between the impeller 28 and the motor 16, a plurality of collateral advantages also result. For example, it is advantageous to have any and all elements of the heater/pump unit 10 that require electricity positioned adjacent the base wall 32 of the pump housing 20. When so positioned, electricity which is required to operate the motor and control circuitry and which is therefore readily available within the motor housing 16, can also be provided through the base wall 32 and need not be provided from an external side of one of the cylindrical outer walls 33, 74. Referring again to FIGS. 2 and 3, the heater aperture 51 is provided in the base wall 32 in an area that is not within the volute channel 38. The mounting extension 92 extends through the heater aperture 51 and into the motor housing 16 where the contacts 93 can be electrically connected. A flat gasket (not shown) can be located around the mounting extension 92 to form a water-tight seal between the extension 92 and the base wall 32.

In addition, as the liquid characteristics within the deepest portion of the volute channel 38 are the characteristics of the liquid exiting the heater/pump unit 10, these are the characteristics which are most likely of interest. Referring to FIG. 1, because the deepest portion of the volute channel 38 (i.e. the exit portion) is formed by the base wall 32, sensors 152 that might require electricity can be located on the motor side of the base wall 32 with an appropriate insert extending therethrough at a point 41 within the volute channel.

It should be noted, however, that for safety purposed, it is desirable to ground all sensors that extend through the base wall 32 and into the pumping chamber 78. Grounding eliminates the possibility of electrocuting a whirlpool occupant if stray current shorts into the insert.

Referring now to FIG. 5, the present invention also includes a circuitry cooling configuration 100. While the motor shown in FIG. 1 limits the overall size of the heater, pump, and motor, if the area provided for mounting the heater/pump unit 10 is severely restricted, both the motor 12 and control circuitry (not shown in FIG. 1) will tend to heat up at an accelerated rate and can damage or destroy both motor components or control circuitry.

The circuitry cooling configuration 100 as shown in FIG. 5 minimizes the area required for the heater/pump unit. Both a motor 12 and a fan unit 102 are located within the motor housing 16. The motor housing 16 includes a plurality of air inlets or intakes 104 positioned near a pump end 105 of the housing and a plurality of air outlets 106 at an exhaust end 107 of the motor housing.

The fan 102 may be constructed in various ways as well-known in the art but should at least include a plurality of vanes which can force air into the motor housing 16 through the inlets 104, past the motor 12, and back out of the housing 16 through outlets 106. The fan 102 is mounted on the drive shaft 15 for joint rotation about the axis of rotation 17 therewith.

In the present invention, the control circuitry 110 is mounted in a separate circuitry housing 112 located within the mounting arrangement 18.

While the circuitry housing 112 and motor housing 16 are separate, a chimney chute 116 extends from a circuitry housing outlet 118 up to at least one motor housing inlet or intake hole 104. At the opposite end of the circuitry housing 112, a circuitry housing inlet 114 is provided in a floor member 120. Support legs 122 are provided on the bottom of the floor member 120 which allow air to pass unobstructed underneath the floor member 120.

Importantly, the control circuitry 110 is located between the inlet 114 and the outlet 118. Preferably, the circuitry 110 is also attached to either the floor member 120 or a heat sink member 124.

While the motor 12 is operating, the fan 102 rotates along with the drive shaft 15. As the fan 102 rotates, the fan draws air along the path identified hy arrows 162, 164 and 166 through the circuitry housing inlet 114, across the circuitry 110, through the chimney chute 116, and into the inlet 104 which is attached to the chimney chute. Importantly, the fan 102 also draws additional air through inlet holes 104 which are not connected to the chimney chute 116 thus mixing the air from the chimney chute 116 with additional cooling air prior to forcing that air over the motor 12. The cooling air absorbs much of the heat produced by the motor 12 and circuitry 110 and finally is forced out the outlets 106.

By cooling both the motor and control circuitry using a single fan, a heater can be included with both a pump and control circuitry in a relatively small space without risking damage from overheating. Minimizing the space required for these components allows a designer to maximize the size of the whirlpool tub.

One way to install an insert in the base wall 32 would be to use an ultrasonic insert. As known in the art, an ultrasonic insert is forced through a wall by a jig tool which applies pressure axially along the length of the insert while the insert is aligned with a small hole. At the same time, the insert is ultrasonically vibrated. This process continues until the insert melts forced through the hole and emerges on the other side. The vibrating melts the plastic around the hole making it easy to enforce the insert therethrough. After the vibrating is stopped, the plastic solidifies and secures the position of the insert. While manufacture and installation of such inserts is relatively inexpensive, the industry has yet to devise a waterproof insert which could be used with the base wall 32 in a liquid pump unit.

Referring to FIG. 6, to provide a watertight ultrasonic insert for use with the present invention, a cylindrical gland 126 is formed on the internal face 34 of the base wall 32. The gland 126 is formed around an insert axis 128. An ultrasonic insert 130 is also provided.

Referring also to FIG. 7, the insert 130 includes a head portion 132 and an extension 134. Preferably, the extension portion includes two annular nubs 136 near its distal end and two spiral knurls 138 located between the nubs 136 and the head portion 132. The head portion 132 includes a first shelf 140 adjacent the knurls 138, a second shelf 142 adjacent the first shelf 140 but separated therefrom, and a face plate 144 adjacent the second shelf 142 and opposite the distal end of the extension 134. A connection aperture 146 is provided in the face plate 144 and extends through the head portion 132 and partially into the extension 134. Preferably, the connection aperture 146 is centrally located within the head portion 132.

Referring also to FIG. 6, importantly, prior to installing the insert 130, an elastomeric O-ring 149 is positioned around the first shelf 140. The gland 126 should be sized so that the diameter between facing internal surface portions is slightly greater than the diameter of the head portion 132 through the external surface 150 so that when an O-ring 149 is placed therebetween, it is slightly compacted. To install the insert, the insert 130 is aligned with a small hole along an insert axis 128, the jig tool (not shown) applies force to the insert 130 along the insert axis 128 in the direction of the pump chamber 78, and the insert is ultrasonically vibrated until it melts through the base wall 32 so that an end is received within the pump chamber 78. As the insert 130 is vibrated, the O-ring 149 is forced up and around the external surface 150 and provides a watertight seal between the internal surface of the gland 126 and the external surface 150. The second shelf 142 is received within the gland 26 and the face plate 144 remains outside the gland 126.

It will be appreciated that in addition to the specified embodiment shown, the invention can appear in other embodiments. For example, referring to FIG. 1, it may be possible to limit the size of the heater/pump unit 10 even more if either the volute channel 38 and/or the heater 26 are positioned around the ball bearing 95.

Any type of heater that can fit in a small area and that is electrically safe could be used with the present invention. The insert shown in FIG. 7 is only shown as an exemplary insert and any type of ultrasonic insert could be used with the present invention and with the gland 126 and O-ring 149 shown in FIG. 6. Furthermore, while FIG. 5 shows one circuitry/motor housing configuration, any configuration wherein circuitry is placed in a separate housing and a fan draws cooling air over the circuitry and then forces air over the motor is contemplated by the present invention.

In addition, the control circuitry may include various temperature and water presence or water pressure sensors that operate to protect the motor and heater components. For example, a separate dual function thermostat may be thermally connected to the heater to provide various functions. First, if the pump is turned on and there is minimal or little water in the pump and the tub, the heater temperature rises rapidly and could result in a dry fire. The thermostat can be used to directly shut off the heater to prevents dry fires. Second, the same thermostat can be used to provide an upper temperature limit which prevents water temperatures from exceeding 120° F. which is the upper temperature allowed.

We claim:

1. A pump for pumping and heating a liquid, the pump being drivable by a motor, the pump comprising:

a pump housing having an internal pump chamber, a liquid inlet into the chamber, a chamber base wall, and a radial outlet, the base wall having an opening therethrough;

a drive shaft rotatably mounted in the opening, the shaft being suitable to be attached to a motor located outside the chamber;

an impeller mounted on the drive shaft to rotate therewith in the chamber, the impeller mounted such that the outlet is between the impeller and the base wall; and

a heater sandwiched in the chamber between the base wall and impeller;

whereby upon operation of the pump and connection of the pump to a liquid supply, rotation of the shaft can draw liquid in from the inlet, past the heater and through the outlet.

2. The pump of claim 1, wherein the inlet opens into the chamber at a position opposite the base wall opening.

3. The pump of claim 1, wherein the drive shaft is an armature of a motor.

4. The pump of claim 1 wherein the heater includes an electrically resistive heating element, an electrical insulator around the heating element, and an electrically and thermally conductive cover covering the insulator, the cover being grounded, so that the cover operates as a current collector.

5. The pump as recited in claim 4 wherein the cover includes a stainless steel tube surrounding the insulation and an aluminum coating cast around the stainless steel tube and the aluminum is grounded.

6. The pump as recited in claim 1, wherein a portion of the pump chamber is a volute having a volute inlet end and a volute outlet end and wherein the volute is deeper at the outlet end than at the inlet end.

7. The pump as recited in claim 1 wherein a ball bearing is included within the opening for receiving and supporting the drive shaft.

8. The pump as recited in claim 1, further including at least one insert that has been forced through the pump housing by ultrasonic vibrations, the insert having an extension extending into the pump chamber and a head end located outside the pump chamber.

9. The pump as recited in claim 8, wherein there is an O-ring at a junction between the insert and the pump housing for providing a seal.

10. The pump as recited in claim 8, wherein a sensor is connected to the head end of the insert.

11. The pump as recited in claim 10 wherein the sensor is a dual function thermostat that can detect water presence and water temperature.

12. The pump as recited in claim 11 wherein the sensor can turn off the heater when no water is present in the pump or when the water temperature exceeds a temperature limit.

13. The pump of claim 10, wherein the insert is thermally and electrically conductive.

14. The pump as recited in claim 10, wherein the sensor is either a water temperature, water pressure, or a water presence sensor.

15. A pump for pumping and heating a liquid, the pump being drivable by a motor, the pump comprising:

a pump housing having an internal pump chamber, a fluid inlet into the chamber, a chamber base wall, and a radial outlet, the base wall having an opening therethrough;

a drive shaft rotatably mounted in the opening, the shaft being suitable to be attached to a motor located outside the chamber, the drive shaft being an armature of a motor;

an impeller mounted on the drive shaft to rotate therewith in the chamber;

a heater sandwiched in the chamber between the base wall and impeller;

whereby upon operation of the pump and connection of the pump to a liquid supply, rotation of the shaft can draw liquid in from the inlet, past the heater and through the outlet;

the motor is enclosed in a motor housing having at least one air intake, and there is a circuit housing positioned adjacent the motor housing near the intake;

control circuitry for the motor and pump is positioned within the circuit housing;

the circuit housing including a chimney chute at a first end that communicates with the intake and an intake hole at a second end opposite the first end; and

the motor includes a fan within the motor housing that forces air through the intake hole, over the control circuitry, through the chimney chute and intake, and over the motor.

16. The pump as recited in claim 15, wherein there are a plurality of air intakes to the motor housing, and the chimney chute communicates with less than all of the air intakes.

17. The pump as recited in claim 1, wherein the heater is donut-shaped and surrounds the drive shaft.

18. A motor unit comprising:

a motor positioned within a motor housing, the motor being controlled by a control circuitry, the motor housing having at least one air intake;

the control circuitry located in a separate chamber from the motor in a position adjacent and upstream the intake; and

a fan connected to the motor, the fan forcing cooling air to traverse an air path over the control circuitry, through the intake, and then over the motor.

19. The motor unit as recited in claim 18, wherein the fan is positioned in the motor housing along the air path between the control circuitry and the motor.

20. The motor unit as recited in claim 18 further including a circuit housing outside the motor housing that defines the separate chamber, the circuit housing having at least one outlet hole at a first end and a chimney chute providing a passage from the outlet hole to the intake and at least one air inlet.

21. A pump comprising:

an internal chamber defined by a pump chamber wall;

an insert that has been ultrasonically driven through the chamber wall so that an extension of the insert extends into the chamber; and

an O-ring positioned at a seam between the insert and the chamber wall for providing a seal.

22. The pump of claim 21, wherein the insert is electrically and thermally conductive.

23. The pump as recited in claim 21 wherein a gland is included outside the pump chamber on the pump chamber wall, the gland surrounding at least a portion of the insert and having an internal surface which opposes an external surface of the insert, wherein the O-ring tightly fits between the internal and external surfaces.

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